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LAMB-BREEDING TESTS.

(*By H. C. Wilson, Manager, Research Farm, Werribee, and A. J. Whelan, Field Officer.*)

The development of the fat-lamb industry during the past ten years has brought into prominence the problem of the most profitable type of lamb to raise for export purposes and local trade.

To test this matter was the object of a series of experiments commenced three years ago at the State Research Farm, Werribee. It is intended to continue the tests for a further period, and in the meantime to briefly review the results to date.

The principle followed was to select first cross ewes of uniform quality and to mate these with representative rams of different breeds.

The main objects of these tests were briefly:—

1. To ascertain the comparative market values of the various crosses.
2. To compare the values of the fleece of each cross at shearing, and
3. To test the prepotency of the various rams used.

Lincoln merino, first cross 4-tooth ewes of uniform type and quality were secured in December, 1912. These ewes were used for the 1913-14 experiments only, young 2-tooth ewes being secured in December of 1914 for the third-year trials. Each year the ewes were divided into six sections, particular care being taken to preserve uniformity throughout.

The following rams were joined with the ewes in January, 1913 and 1914:—Lincoln, Border Leicester, English Leicester, Dorset Horn, Shropshire, and Southdown. In the third year, however, it was decided to replace the English Leicester with the Suffolk, and mating

took place in January, 1915, with the following six rams:—Lincoln, Border Leicester, Suffolk, Dorset Horn, Shropshire, and Southdown.

During the first year fifty ewes were used in each section, whilst forty were used in the second and third years.

All the ewes were branded and tagged to avoid any possible errors before being joined with the rams. A typical flock ram of each of the above breeds was selected with the object of preserving comparative uniformity in each section of the trials.

Mating and Gestation Period.

In the third week of January of each year the rams were joined with the ewes in each group of sheep and placed in equal and separate paddocks; but in order to secure equality of feeding the sheep were moved from paddock to paddock in regular rotation during the season of mating. The rams were drawn after a period of seven weeks from the time of joining; the six separate lots of ewes were boxed and pastured together until a fortnight before lambing, when they were drafted according to brands and ear tags, and again placed in separate paddocks for the lambing season.

Lambing Percentages.

Lambing usually started in late June and early July, and from Table No. 1 it will be seen that both breed and season show influences on the lambing percentages:—

TABLE No. 1.

LAMBING PERCENTAGES.

Breed of Ram.	1913.					1914.					1915.					Average per cent Alive 3 Years.
	No. of Ewes Mated.	No. of Lambs Dropped.	No. of Lambs Alive.	No. of Lambs Dead.	Percent. of Lambs Alive.	No. of Ewes Mated.	No. of Lambs Dropped.	No. of Lambs Alive.	No. of Lambs Dead.	Percent. of Lambs Alive.	No. of Ewes Mated.	No. of Lambs Dropped.	No. of Lambs Alive.	No. of Lambs Dead.	Percent. of Lambs Alive.	Percent of Lambs Dead.	
Lincoln ..	50	62	51	11	102	40	33	32	1	80	40	48	38	10	95	25	92·3
Border Leicester ..	50	47	42	5	84	40	37	36	1	90	40	37	35	2	87·5	5	87·10
English Leicester	50	52	41	11	82	40	42	40	2	100	Nil*	..	..	..	..	..	91‡
Dorset Horn ..	50	49	43	6	86	40	43	40	3	100	40	37	34	3	85	7½	90·3
Shropshire ..	50	51	41	11	82	40	37	36	1	90	40	36	33	3	80	7½	84
South Down ..	50	49	48	1	96	40	34	33	1	82·5	40	11	36	5	90	12½	89·5
Suffolk* ..	..	..	..	..	..	..	..	..	..	..	40	31	27	7	69·5	17·5	..

* Not in Experiment 1913 and 1914. † Not mated 1915. ‡ Average for two years.

There were a number of lambs lost each season; the heavy mortality in the first year may be attributed to the bleak conditions, absence of

shelter, and cold winds, which predominated particularly in 1913; 1914 was milder, and consequently the percentage of deaths was lower.

In the third year the old ewes were sold, and 2-tooth ewes were secured of similar quality to further the experiment. Young rams were also purchased, the old ones being sold with the ewes in December of 1914.

The mating of 2-tooth ewes and rams naturally resulted in somewhat lower percentages in the third year, and a few weak lambs. Particularly was this the case in point of the Lincoln cross, where numbers of twins were born and were unable to be supported by their young mothers.

The low percentage of the Suffolk cross in the third year can, I think, be attributed to the fact that the stud which this ram was drawn from had only been imported from England a few months before the mating period.

Crossbred Ewes with Lincoln Ram.

We hope to be able to show very much higher lambing percentages this season (the fourth year of the trials), because the ewes and rams are now 4-tooths, very strong and vigorous, and the season promises to supply better conditions than have been experienced for the past three years.

Data Recorded During Lambing and Growth of Lambs.

No. 1.—Lincoln Cross.

Lambing in this section seemed in the first two years to occur regularly in the early part of July. In 1915 the lambing in this cross seemed more distributed than it was in the two earlier years, but this was in keeping with the other crosses, and no doubt has for its explanation the fact that both ewes and rams were young.

A marked feature in the development of these lambs was the fact that they grew rapidly, produced an abundance of wool, but did not fatten like the Down crosses until nearing maturity.

No. 2.—Border Leicester Cross.

These lambs came also very regularly in the early part of July, grew rapidly, and showed the distinctive character of the Border Leicester sire. They possessed great length and height of body, and a wool somewhat lighter in quality than the Lincoln cross, but better than the Down crosses. They did not seem to be in the pink of condition as freezing lambs until they had reached the age of sixteen to seventeen weeks. The lambs were undoubtedly hardy, and the percentage of deaths was very much lighter than was the case with the Lincoln cross; in fact, the mortality was as low as any of the crosses, and compared favorably with Southdown.

Crossbred Ewes with Border Leicester Ram.

No. 3.—English Leicester Cross.

This section of the experiment was only carried out for two years, and was replaced in the third by the Suffolk cross, it being thought that the Border and English Leicester crosses were too similar in character, and after deciding to include the Suffolk the English Leicester cross was dropped in its favour. The lambs of the English Leicester cross were born somewhat more irregularly than either the Lincoln or Border Leicester, and did not grow quite so well, nor come to maturity any quicker than either of the above crosses. The wool was somewhat similar to that of the Border Leicester, but at shearing time it was found that the ewes cut slightly heavier fleeces. These English Leicester cross lambs seemed to come to maturity between sixteen and seventeen weeks of age.

No. 4.—Dorset Horn Cross.

The lambs of this cross seem in the face of the facts which we have gathered during the past three years of the experiment to be unpopular

Crossbred Ewes with Dorset Horn Ram.

Crossbred Ewes with Shropshire Ram.

with the buyers at Newmarket. Though the lambs themselves seem to fill every particular in regard to quality and maturity percentage, they failed to attract the buyers.

Lambing was regular and frequent in the early weeks of July; the lambs grew quickly, were fat all the time, and retained comparatively heavy carcass weights when slaughtered. The wool seemed to be a great deal shorter than that from the long-woolled crosses, and somewhat lighter in character. A prominent growth of horn is unquestionably the unpopular feature from the buyers' stand-point, and some butchers claim that the carcass when hung is too long and bony.

No. 5.—Shropshire Cross.

This cross of lambs seem to drop throughout the three years of the experiment somewhat more irregularly than the long-woolled sections, although they showed decided uniformity and fair quality throughout their growing period until maturity about the sixteenth week. The lambs had a tendency during the later weeks of the growth to develop an excessive quantity of wool about the face and eyes; this is a feature

Crossbred Ewes with Southdown Ram.

which somewhat explains their comparative unpopularity if kept as weaners. As a freezing lamb, however, they are undoubtedly popular amongst the buyers.

The fleece is shorter than the long-woolled crosses, but the weight compares favorably with both the Border and English Leicester. A conspicuous feature in this cross was the total absence of twin lambs during the three years of the experiments.

No. 6.—Southdown Cross.

The lambs in this cross were dropped regularly early in July each year, the percentage of deaths was very low, and the percentage of lambs raised compared favorably with the averages of the other crosses. Very few twin lambs were born, and this probably accounts for the average lambing percentage recorded. The lambs were exceptionally hardy,

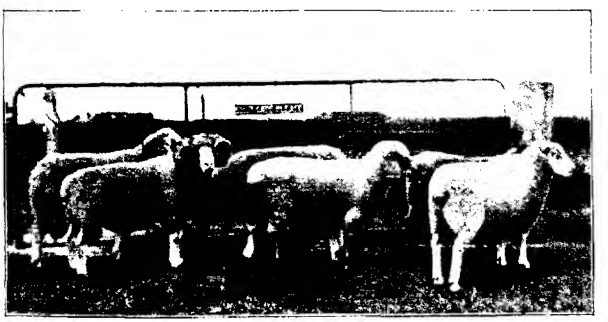
and are adaptable to weather the severe winters which are prevalent on the Werribee plains. The Southdown cross lambs seem to be able to retain their lambs' fat fully until maturity, and were prime from fourteen to fifteen weeks of age.

The wool is short and light, and this cross should be profitable where early, quick-maturing freezing lambs are intended to be produced at handy distance from the market.

Crossbred Ewes with Suffolk Ram.

No. 7.—Suffolk Cross.

The Suffolk is a comparatively new breed to Australia, and at present only isolated flocks are in existence. In 1915 this breed was introduced into the fat-lamb trials, and last year the lambing records



Rams used in tests.

were low, the percentage of deaths considerably above the average, and undoubtedly the results may be accounted for by the fact that the Suffolk ram used was hardly acclimatised, being recently imported from England.

The lambs were not dropped until the end of July, although the mating was effected at the same date as the other crossess: but, despite this fact, the lambs at fourteen to fifteen weeks were as heavy as the

heaviest of the other crosses at seventeen weeks, which speaks volumes in favour of this cross in respect to their early-maturing and rapid-growing qualities.

The wool on the lambs is undoubtedly scanty on the belly, face, and points, but the extra bulk of carcass presents surface for wool production, and the comparative weights of the lamb fleece can be noticed in Table No. 3.

Marketing of the Wether Lambs.

At approximately seventeen weeks the wether lambs of each of these crosses were weaned, drafted from the ewe lambs, and sold at the Newmarket sale yards in separate and presentable lots to create genuine and comparative competition among the buyers for slaughtering as butchers' supplies or freezing for export.

These wether lambs were sold in the wool, and their comparative values realized at Newmarket were published in the daily papers for the past three years. Table No. 2 shows the comparative results to date.

TABLE II.

LAMB BREEDING TRIALS.

Return *re* Wether Lambs *ex* First-cross Lincoln-Merino Ewes at Maximum Age of Seventeen Weeks.

Ram.	No.	Auction Price realised.	Average Live Weight.	Maximum Weight of Carcass.	Minimum Weight of Carcass.	Average Weight of Carcass.	Average Weight of Pelt.	Average Weight of Offal.	Per Cent. Offal Loss.
Season 1913 Results.									
		£. s. d.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
Lincoln	22	15 0	69·36	42·0	29·0	35·5	9·95	23·91	34·5
Border Leicester ..	20	13 9	68·6	44·0	28·0	36·8	8·35	23·45	34·2
Dorset Horn	20	13 6	74·2	53·5	31·5	40·15	9·1	24·95	33·6
English Leicester ..	20	13 1	69·5	42·5	25·5	35·95	8·55	22·5	33·8
Shropshire	23	12 10	67·6	55·5	28·5	36·06	8·73	22·77	33·7
Southdown	21	11 6	5·96	42·0	26·0	32·0	7·61	19·04	32·4
Average	..	13 3	67·5	46·6	28·1	36·07	8·71	22·57	33·7
Season 1914 Results.									
Border Leicester ..	15	16 2	85·83	58	37	44·10	9·20	33·50	38·5
Dorset Horn ..	15	14 11	85·11	51	35	43·10	8·80	33·50	39·13
English Leicester ..	15	14 1	77·0	45	31	37·0	10·2	29·80	38·7
Lincoln	15	14 0	80·0	50	29	39·0	11·40	29·60	37·0
Southdown	15	14 0	71·49	44	27	36·13	10·6	27·42	38·22
Shropshire	15	13 19	71·50	41	24½	34·7	10·33	26·47	36·92
Average	..	14 6	78·95	48	30½	39·0	10·08	30·05	38·08
Season 1915 Results.									
Suffolk	13	26 0	90·5	60	39	47	10·0	33·5	37·0
Border Leicester ..	12	25 10	93·33	59	38	47	11·33	35·0	37·5
Shropshire	19	25 0	88·0	56	36	44	10·0	34·0	38·6
Lincoln	17	24 3	80·75	55	30	37	11·5	32·25	39·9
Southdown	14	23 2	80·0	50	31	39	9·5	31·5	39·3
Dorset Horn	12	23 0	84·0	50	34	41·5	9·0	33·5	39·8
Average	..	24 6½	84·76	55	34·66	42·58	10·22	33·29	38·68

Shearing of the Ewe Lambs and their Wool Values.

To ascertain the true value of the different crosses in this experiment from a wool-producing stand-point, the ewe lambs from each cross were retained for three weeks after the sale of the wethers and shorn, and the fleeces were classed and valued. This was undertaken by Mr. Plummerage, Wool Expert of the Gordon Technical College, and we are greatly indebted to him for his careful work which he has done so willingly. Table No. 3 shows the comparative weights, quality, and values of the seven crosses in the experiment.

TABLE III.

LAMB BREEDING TRIALS.

Results of Ewe Lambs Shorn and Values of Wool Seasons 1913-14.

Ram used.	No. of Lambs Shorn.	Weight of Wool.	Firsts.	Seconds.	Quality of Wool in Bradford Counts.	Value of Wool. Firsts.			Seconds.			Value of Wool per Lamb.			Class Yield, Scoured.	
		lbs.	lbs.	lbs.		*s.*	*s.*	*d.*	*s.*	*d.*		*s.*	*d.*		%	%
Lincoln ..	39	126·9	105·9	21	44 -46	0	9½		0	6¼		2	5¾		61·40	58·25
Border Leicester	43	88·58	78·26	10·32	48 -50	0	10		0	6½		1	8⅝		65·62	56¼
English Leicester	39	101·4	84·63	16·77	44 -46	0	10½		0	6⅝		2	1·6		71·87	56½
Dorset Horn ..	48	106·56	89·28	17·28	48 -52	0	10½		0	6⅝		1	10		57·81	56¼
Shropshire ..	42	92·0	81·0	11·0	48 -56	0	8½		0	6¼		1	6·14		65·62	56¼
Southdown ..	38	87·78	71·44	16·34	50 -56	0	8¼		0	6¼		1	7¼		56¼	56¼
Season 1915.																
Lincoln ..	20	82·40	67·0	15·40	40—56	0	9½		0	7¼		3	1·63		65·2	56·88
Border Leicester	22	68·20	51·70	16·50	50—60	0	10½		0	8½		2	7·46		68·64	63·71
Suffolk Cross ..	9	36·45	27·72	8·73	56	0	8½		0	6¾		2	8·18		57·20	58·45
Dorset Horn ..	19	48·45	36·48	11·97	58	0	11		0	7¾		2	1·84		72·0	63·48
Shropshire ..	13	45·83	34·97	10·92	50 -56	0	9		0	6½		2	6·51		72·28	56·0
Southdown ..	20	45·20	31·80	13·40	56 -58	0	8½		0	6		1	5·45		74·0	59·71

In the above table the wool yields for the years 1913 and 1914 were placed together for valuation. By so doing the comparative results have not been altered.

SURPLUS LUCERNE HAY.

By Temple A. J. Smith, Chief Field Officer.

Recent complaints by growers, that present prices for lucerne hay, viz., £4 per ton, are not sufficiently remunerative, open up the question as to whether the most profitable method of disposing the crop, is to place it on the market in large quantities in seasons of plenty when there is an abundance of lucerne, oaten and wheaten hay, and natural grasses.

The purchaser of hay from the grower buys to make a profit on the material handled, a profit that the grower himself should be able to pocket, provided he goes the right way about it. This fact has been realized by farmers in other parts of the world, with the result that hay and grain is fed to stock of various kinds on the farms on an enormously greater scale than is the case in this State. Taking the maize crops of the United States, America, as an instance, we find that no less than 75 per cent. of the crop is fed on the farm, only 3 per cent. is exported, and the balance, 22 per cent., fed to horses, &c., in the city, and this in the largest maize-producing country in the world. It is obvious that all fodders carry a certain food value, which varies from time to time, according to the prices of beef, pork, milk, &c., and the owner of such fodders should make it his business to ascertain when and where it pays him best, to either sell in the open market, or utilize his material at home.

There is an immediate saving in feeding fodder on the farm, in that the cost of baling, wire, carting to rail, trucking, commission, &c., is avoided—these items alone amounting to 25s. to 30s. per ton on lucerne hay, and proportionally on other crops. Added to this inferior hay of bad colour, or poorly-harvested hay, which might be almost unsaleable, could be turned into money through stock feeding, which might otherwise be an absolute loss. Further, the more stock the farm can be made to turn off, the more manure will be available, thus keeping up the standard of fertility of the land and increasing the reputation of the farm as a money producer, and a higher value per acre would naturally follow.

Lucerne, properly speaking, should not be fed by itself to secure the best results, but should be supplemented with grain, bran, pollard, or concentrates of some kind in order to make up a balance ration for especial purposes. When lucerne hay is used for pigs, it should also be ground fine to prevent waste, and to aid digestibility should be softened by soaking in water.

Feeding for Pork.—The following results of experimental feeding for pork give a useful idea as to the quantities required and the comparative values when fed to various kinds of stock.

Approximately, 14 lbs. of lucerne will make 1 lb. of pork when fed to pigs, consequently 2,240 lbs. of lucerne will produce 160 lbs. of pork, which, at 6d. per lb., gives a return of £4 per ton for the hay on the farm, equivalent to £5 10s. on the market after all costs of baling, freight, &c., have been deducted. When prices for pork reach

1s. per lb., as is the case at the present time, the value of the lucerne would be doubled, and it appears somewhat extraordinary that this has not been realized earlier.

Green lucerne for pigs is better than hay, and lucerne mixed with maize, wheat, bran and pollard, in proper proportions, will result in even better profits. Henry, on "Feeds and Feeding," says:—"Where pigs are pastured on lucerne and fed 2 lbs. to 2½ lbs. of maize per 100 lbs. of pig per day, the amount of maize required to produce 100 lbs. gain in weight is 331 lbs."

Lucerne pasture is admittedly better than any other for pigs, but it should not be overstocked, and small paddocks should be used so that the lucerne from time to time, may be cut for hay. This has the effect of sustaining the lucerne plots.

Cotrell, of the Colorado Station, states "that pigs fed with grain and lucerne will make, under good management, 500 lbs. to 1,000 lbs. gain from an acre of lucerne, after deducting the gain due to the feeding of the grain."

Feeding for Milk.—For milk production in a trial lasting twelve weeks with 8 cows at the New Mexico Station, Vernon found that 216 lbs. of lucerne hay alone produced 100 lbs. of milk. These results have been confirmed elsewhere. Taking the milk at 6d. per gallon this leaves £2 5s. per ton of hay on the farm to £3 15s. per ton on the market. This is apparently low, but when dairying is followed the bulk of the lucerne would be fed green, and the cost of hay making avoided, also lucerne should be fed to dairy cows with concentrates in order to obtain full values, and by products from the cows increase the returns.

Fattening Cattle and Sheep.—When fed to steers two years old 1,100 lbs. of lucerne hay gave 100 lbs. gain; therefore, 1 ton of hay should give 200 lbs. gain, which, at 6d. per lb., would equal £5 per ton, and at 4d. per lb. equal £3 6s. on the farm.

Here again, if fed green a saving in cost and labour would be made, also the prices taken for meat are far below present values.

For raising fat lambs for export the cheapest system is to provide small paddocks in which the lucerne can be allowed to reach its maximum growth before the sheep are turned in, and constant changes to fresh paddocks made. One cutting each year for hay from every paddock should be obtained, and a good system of cultivation followed in all.

In buying stock for fattening care should be taken to secure animals likely to return the greatest profit, as for instance, 6 or 8 tooth sheep will fatten quicker, and at less cost than either very young or old sheep. A good dairy cow will also give a greater proportionate return than a cow with a smaller milk yield for the amount of food supplied, while in the case of pigs good forward stores of the right weights will result in a quicker turn over and larger profits. It does not follow that the lowest priced stock of any description are the cheapest, as much depends upon suitability for the purpose required, and the margin of profit on the higher priced stores may easily be greater than that on the cheaper lines.

Further, it is obvious that were the hay or green fodder more generally used on the farms, markets would not be glutted to the same extent; this would insure better market values.

RESEARCHES ON WHEAT SELECTION.

1. Does the Value of a Wheat Grain Depend on its Position in the Ear?

A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent, and W. Heber Green, D.Sc., Lecturer in Agricultural Chemistry, University of Melbourne.

In 1912 a series of experimental plots were laid out at the Rutherglen Experiment Farm with the object of determining the extent to which improvement of wheat was possible by various methods of selection. This was a continuation of work which had been carried out at the Parafield Wheat Station by one of the authors.* A question which arose at the outset was "Are all the grains of the wheat ear as like to one another as the proverbial two peas in a pod?" or have they an individuality which finds its expression in their varying vitality under which we may include germinating capacity and prolificacy? In other words, does the value of a wheat grain depend on its position in the ear?

At the suggestion of Mr. T. M. Whelan, Field Officer in charge of the plots, an experiment was carried out in 1913, in which an ear of wheat was dissected and each individual grain was planted in such a position that its identity could be established.

Unfortunately, an accident prevented the resultant crop from being harvested and the weight of individual plants determined at Rutherglen, and in 1914-15 similar tests were made at the State Farms at Rutherglen and Werribee, with more complete material, and it is proposed in this preliminary paper to briefly record some of the results of this part of the investigation.

Up till 1913 the seeds were planted in nursery rows, but the variations in yield of individual plants from one end of the row to the other were considerable, and suggested that these differences were due, not to inherent genetic factors, but mainly to environmental influences. In the endeavour to eliminate these environmental variations a modification of the system of centgener plots suggested by Hays† has been used for the last two years

The essential feature of this system is that 100 grains are planted in ten rows of ten plants each, and this square is protected by one or more border rows of grain of similar parentage.

At harvest time the border rows are first removed and the prolificacy of the seed under investigation is determined by the aggregate yield of the 100 plants. The mechanical device for planting these seeds with accuracy, at a uniform distance apart and at a uniform depth, has been previously described in the *Journal*.‡

In preparing the soil for the centgener plots great care was taken to secure as uniform a seed bed as possible.

To avoid the differential soil packing caused by the tread of the horses, the harrows and roller were hauled across the field with the aid of long ropes and pulleys care being taken to avoid any overlap

* *Journal of Agriculture*, South Australia, 1910.
† W. M. Hays, Plant Breeding Bulletin 29, Dept. of Agriculture, U.S.A.
‡ *Journal of Agriculture*, Victoria, November, 1914, p. 649.

of these cultivating implements and consequent extra tilth of narrow strips. Neither horses nor workmen trod on the plot throughout the period of preparation. When ready for planting long planks were placed along the spaces intended for paths, and by arranging the centgener plots in squares of four, it was possible to plant the seeds with the centgener planting board without putting foot on any of the soil reserved for the plants.

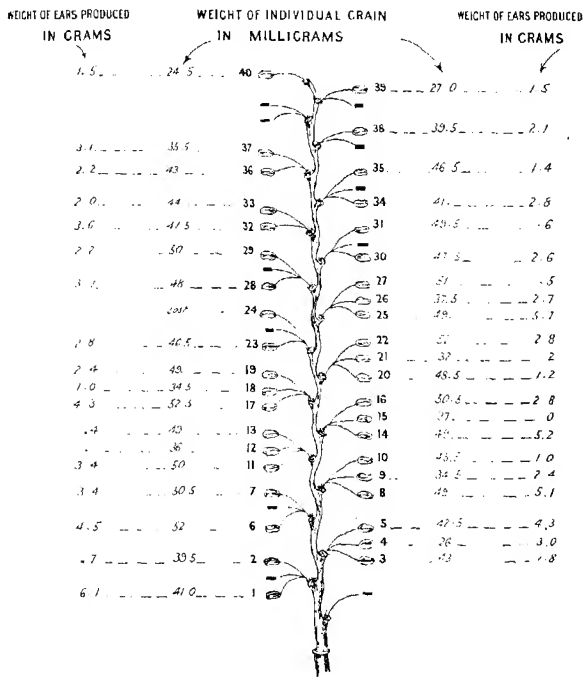


Fig. 1.—Diagram of ear of Federation Wheat, showing position of grains in ear and their individual weights and prolificacy.

In order to prevent any plant surrounding the blanks caused by the non-germination of seed securing an advantage over their less fortunate competitors, seeds of Indian II, an early maturing variety of wheat, were used to fill up these gaps. Thus we endeavoured to insure that in each plot 100 plants of known parentage should struggle for an existence on terms of equality in a uniform environment.

A brief reference to the structure of the wheat ear is now necessary. Botanically, the ear is a spike, bearing on alternate sides of a flattened

rachis a series of spikelets, each consisting of one, or two, or more florets which, unless sterile, ultimately carry the ripe grain. The spikelets normally carry two to three grains, but when seasonal conditions are favorable four or five may develop.

The variety selected for investigation was Federation, whilst typical ears of College Eclipse and Huguenot were also examined. Each grain was removed from the ear by a forceps, identified by a number, and weighed on a microbalance* designed for the purpose, and finally planted in a recorded position in a centgener plot.

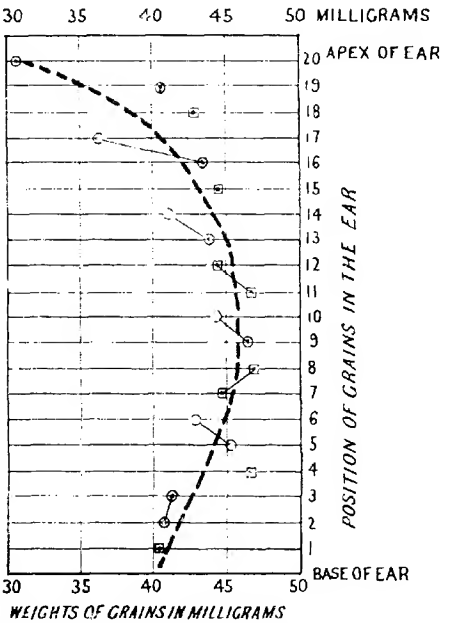


Fig. 2.—Graph of weights of individual grains in a small ear of Federation Wheat.

The germination was determined at intervals and notes on the early growth taken. When ripe the whole plant was removed by the roots, weighed, and the amount of grain obtained.

In weighing the grains prior to planting, and marking their position in the ear, it soon became apparent that well defined relationships existed between the weight of the grains and their position in the ear.

* Society of Chemical Industry, Victoria, 1915, p. 268.

In all over 1,500 separate weighings were made, involving forty-three ears of wheat. Two outstanding features were noted:—

1. The weights of the individual kernels towards either extremity of the ear, and particularly towards the apex, were invariably less than the kernels in the middle of the ear.

2. Where three or more grains were produced on the one spikelet the tendency was for one of the inner or *median* kernels to suffer in its development; hence it was found that, as an almost invariable rule, the grains in the centre of the spikelets are lesser in weight, impoverished, and, if they happen to germinate, produce inferior plants.

These points are graphically illustrated in the diagrams:—

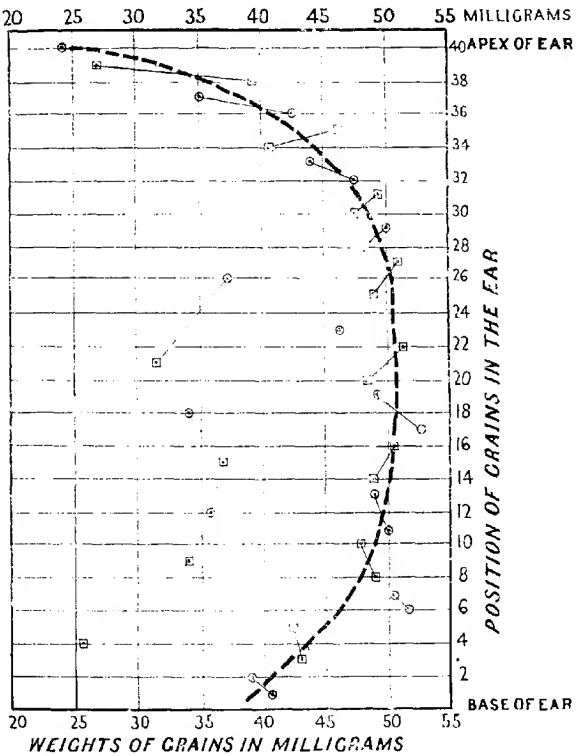


Fig. 3.—Graph of weights of individual grains of a typical ear of Federation Wheat (See also Fig. 1).

Fig. 1 is a diagrammatic representation of one of the ears of Federation wheat examined, showing the position of each grain in the ear, and giving its weight in milligrammes as obtained by the microbalance, and the weight of the ears obtained by growing the resultant plant in a centgener plot.

A perusal of the figures representing the weights of the individual grains show that the intermediate grains of each spikelet are of considerably less weight than those of the outside grains of the same spikelet. Further, it will be noted that the grains towards either extremity, and particularly the apex, are also undersized, and on the average produce relatively small yields.

These points are more strikingly illustrated in Figs. 2, 3, and 4, where the weights of individual grains in milligrammes have been plotted against their position in the ear.

They represent typical ears with maxima of 2, 3, and 4 grains per spikelet respectively.

The grains taken from the same spikelet are connected by faint lines, and these from the right and left spikelets are denoted by small squares and circles respectively. The dotted line represents the general trend of the weights from the base to the apex of the ear. As already noted, there is an increase in the weights of kernels as we pass from either extremity to the middle of the ear.

In Figs. 3 and 4 the intermediate grains have been plotted separately from the outside grains of the corresponding spikelets, and are connected in the diagrams by faint dotted lines. The graph shows clearly the lesser weights of the median grains as compared with the adjoining grains of the same spikelet.

It is obvious that the weight of the ears produced show considerable and erratic variations in spite of the elaborate precautions to insure uniformity of growing conditions: but, by taking the average of a number of experiments, these individual fluctuations do not prevent definite conclusions being arrived at.

In order to compare the relative germinating capacity and prolificacy of the median grains and the other small grains at the base and tip with that of the remainder of the grains of the ear, the results as obtained from three of the typical Federation heads which were dissected may be quoted. As indicated above, each grain was planted in recorded positions in centgener plots, and the weight of ears from each plant obtained after harvesting.

The results are summarized in Table I.:—

TABLE I.

COMPARISON OF YIELD OF PRODUCE FROM MEDIAN GRAINS WITH THAT FROM HEAVY GRAINS WHICH ORDINARILY COMPOSE FIRST GRADE WHEAT.

Group.	Treatment.	No. of grains taken.	Average Weight of Seed.	Percentage Unproductive.	Average weight of ears produced per plant.
			Milligrammes.		Grammes.
1	All *median* grains and grains under 35 milligrammes	38	27·8	16%	1·81
2	Grains over 35 milligrammes	80	43·5	4%	2·86

These figures show that the median grains, together with the light grains at either extremity of the head, have a lower percentage of germination and give a much lower average yield than the grains of the remainder of the head.

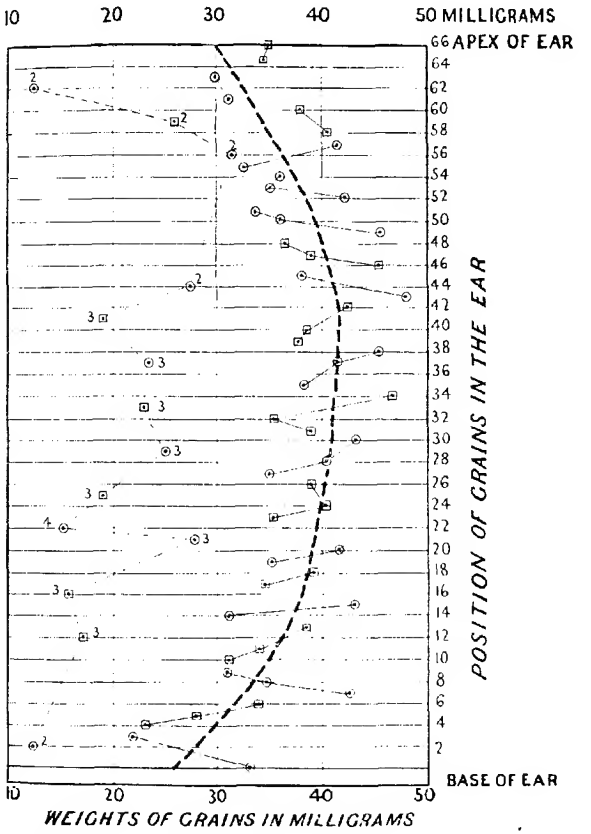


Fig. 1.—Weights of individual grains in a large ear of College Eclipse Wheat.

Hence prime seed, coming from a centrifugal barrel grader (which separates grain into grades according to the weight and size), should be expected to give increased returns over ungraded seed. The grading eliminates the majority of the non-prolific median grains and the undersized, unproductive grains from the extremities of the ear.

It is also evident that in applying mass selection to wheat for an improvement in yield, improvement would more rapidly follow if the upper and lower portions of the selected ears were rejected, and the balance of the ear threshed and graded to eliminate the less prolific *median grains.*

We wish to express our appreciation of the hearty co-operation of Field Officers G. S. Gordon, H. A. Mullett, and T. M. Whelan, who have assisted in the arduous work entailed in the preparation, planting, and harvesting of the centgener plots.

SUMMARY.

1. The weight of the individual grains may be described as following the shape of the ear, the grains increasing in weight from either extremity to the middle of the ear.

2. The median kernels of the spikelets are invariably lesser in weight and impoverished, and if they germinate they produce less prolific plants.

3. As these grains are undersized and low in weight an efficient grading machine will eliminate them.

4. These results justify the practice, often recommended, of rejecting the upper and lower portions of the ears and grading the remainder when applying mass selection to wheat for an improvement in yield.

(To be continued.)

FARM BREVITIES.

The best advice for the man engaged in mixed farming is to keep on mixing. Do not let a rush of wheat push everything else out of the way.

France is the only country in Europe that is self-supporting in normal times. The country produces sufficient corn and meat for the whole population.

German starch factories, making starch from potatoes, represent a thriving industry. The turnover of the co-operative starch factories before the war was about £3,500,000 a year.

A middle white sow belonging to Mr. E. Kemp Toogood, Southampton (England), has given birth to twenty-two live pigs at a farrow. The same animal in 1913 produced twenty-one young at a birth.

It pays to let all farm animals have access to powdered charcoal. They will usually eat it freely. Most of the so-called stock foods contain charcoal as one of the most useful ingredients.

Cowsheds should be kept in a condition of great cleanliness, and even the air that the animals breathe should be pure. These two conditions are indispensable for the production of sound, good milk.

The light of a lamp will be much clearer if a small lump of salt is placed in the bottom of the lamp reservoir. Also before screwing in the burner, soak the wick in vinegar, then thoroughly dry before using. This makes it burn brighter and last longer.

RESULTS OF EXPERIMENTS, 1915.

A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.

I.

PERMANENT ROTATION TESTS—WERRIBEE.

An interesting demonstration of the value of a systematic rotation of crops on hay and grain yields is afforded by the results obtained from a series of tests at the State Research Farm, Werribee. The tests were commenced three years ago on land which was known to have been cropped continuously for twenty-six years, and which was in a very low state of fertility. It was anticipated that such worn out land would respond more quickly to the influence of rotation cropping than newer land. Ten different systems of crop rotations were tested side by side, with the object of determining which system would give the greatest returns per acre over a series of years. In four of the rotations hay was grown, and in the remainder wheat was the principal crop. On some plots wheat and hay were grown continuously year after year; on others these crops were alternated with bare fallow. On others again forage crops, such as peas, barley, and rape were grown in rotation with the principal crop. The results were as follow:—

WHEAT CROPS.

	bus.	lbs.
1. Wheat after wheat continuously	10	26
2. Wheat after bare fallow	21	54
3. Wheat after peas and rape	23	53
4. Wheat after bare fallow and pasture (Mallee rotation) ..	22	37
5. Wheat after bare fallow, pasture, oats (Wimmera rotation)	24	43
6. Wheat after peas and barley	27	15

HAY CROPS.

	tons.	cwt.
1. Oaten hay continuously	1	6½
2. Oaten hay after bare fallow	2	12½
3. Oaten hay after bare fallow and barley	3	1½
4. Oaten hay after peas and barley	2	13½

The rainfall during the growing period of the crop was 10.84 inches. A perusal of these returns reveals the following results:

1. The continuous cropping of land with the same crop, a method frequently practised in the district, gives returns which barely pay expenses of production.

2. By bare fallowing increases of 11 bushels of wheat and 26 cwt. of hay were obtained over the continuously cropped plots.

3. The greatest and most profitable increases, however, were obtained by growing wheat and hay in rotation, with forage crops such as peas and barley. The wasteful bare fallow is thus eliminated, a crop is grown every year, and the final crop is as heavy as that grown after a

bare fallow. Thus wheat grown after peas and barley in a three-course rotation gave 27¼ bushels per acre as against 24¾ bushels when grown after bare fallow, as in the Wimmera rotation. Similarly the hay crop after peas and barley gave a return of 2 tons 13½ cwt., as against 2 tons 12¼ cwt. when grown after bare fallow.

These results suggest that in districts similarly situated to Werribee, enjoying a fair rainfall, wheat and hay crops grown in rotation with forage crops may be expected to give greater returns per acre than any other method of rotation. Such practises assist in maintaining the fertility of the soil unimpaired.

An example of the success of such rotation may be seen from the yield of a 100-acre hay crop at the Werribee farm. This field was cropped in 1913 with wheat, in 1914 with peas, and fed off with sheep, and in 1915 with oats. Under this system of rotation the average yield from this field exceeded 3 tons per acre.

PERMANENT FERTILISER TESTS -WERRIBEE.

The yields of wheat in the Permanent Fertiliser Trials at the State Research Farm, Werribee, for the season 1915 afford some interesting comparison of the value of differential manurial dressings on the wheat yield. Twenty plots of a ½ acre each were set apart for the testing of different combinations of fertilisers on the growth of wheat. The rainfall up to the end of November was 15.22 inches, of which 10.84 inches fell during the growing period; and the yields of the different plots varied from 19 to 30 bushels per acre. The following table summarizes the results for 1915, and also shows the average yields for the past three years: –

	Season, 1915.	Average for Three Seasons, 1913-14-15.
	Bushels.	Bushels.
1. No manure	20	11
2. Superphosphate, ½ cwt.	27½	16
3. Superphosphate, 1 cwt.	28¾	17¾
4. Superphosphate, 1½ cwt.	29	18
5. Superphosphate, 2 cwt.	28	18
6. Superphosphate, 1 cwt., and nitrate of soda, 40 lbs. (with seed)	30	17¼
7. Superphosphate, 1 cwt., and nitrate of soda, 49 lbs. (in spring)	30	17½
8. Superphosphate, 1 cwt., and sulphate of potash, ½ cwt.	28½	16½
9. Superphosphate, 1 cwt.; sulphate of potash, ½ cwt.; and nitrate of soda, ½ cwt...	28	15¾
10. Bone fertiliser, 1 cwt.	25½	13
11. Thomas' phosphate, 1 cwt.	25½	13
12. Superphosphate, ½ cwt.; Thomas' phosphate, ½ cwt.	26¾	14¾
13. Superphosphate, 1 cwt.; and lime, 5 cwt.	28½	15¾
14. Superphosphate, 1 cwt.; and lime, 10 cwt.	27¾	15¼
15. Superphosphate, 1 cwt.; and lime, 20 cwt.	27	14½
16. Stable manure, 10 tons per acre ..	24½	15¾
17. Stable manure, 10 tons; and lime, 10 cwt.	26½	16
18. No manure (continuously cropped) ..	19¾	10¾
19. Superphosphate, 1 cwt. (continuously cropped)	22¾	14

The past season has been fairly favorable for wheat at Werribee, and as the late spring rains assisted the development of the more backward plots the response to the differential treatment with fertilisers is less noticeable than usual. The results, both for the 1915 crop and the averages for the last three years, appear to justify the following tentative conclusions:—(1) Superphosphate is the most profitable of all artificial manures that can be applied to the wheat crop; (2), the amount that can be profitably applied per acre is considerably in excess of what is applied in general farm practice in the wheat areas; (3), the gross profit per acre over unmanured land steadily increases as the application increases from ½ cwt. to 1½ cwt.; (4), the highest net profit, however, is obtained by applying 1 cwt. of superphosphates per acre. Thus, taking the average of the three years' tests, ½ cwt. of super., costing 2s. 6d. per acre, gave an increased yield of 4 bushels 54 lb., which, at 4s., gives a net profit of 17s. 1d. per acre over the unmanured plot. A dressing of 1 cwt., costing 5s. per acre, gives an increased yield of 6 bushels 41 lbs., or a net profit of 21s. 7d. per acre, after deducting the cost of the manure. Moreover, the indirect effect of the heavier dressing, in stimulating the subsequent growth of grass, and increasing the stock-carrying capacity of the land, is much greater than that of the lighter dressing; (5), basic slag and bonedust applied either separately or in combination with superphosphates give less profit than the same quantity of superphosphates applied by itself; (6), lime, applied either in heavy or in light dressings, has not, so far, profitably influenced the yields of wheat at Werribee; (7), nitrogenous manures do not increase the net profits in ordinary seasons, especially when bare fallowing is practised. Nitrate of soda gave a substantial and profitable impetus to the hay crop during the past season, but its effect on the grain crop has barely covered the cost of application. In view of the high prices ruling for wheat in the world's markets, the questions of quantities and kinds of fertiliser to use are of relatively greater importance than in times when low prices prevail.

The results obtained at Werribee may be considered as typical of what response may be expected from the various fertilisers in districts with a rainfall of 10 inches to 12 inches during the growing period of the wheat.

PERMANENT MANURE TESTS LONGERENONG.

The results for the 1915 manurial trials conducted by the Department of Agriculture at the Longerenong Agricultural College afford an interesting illustration of the fertility of the Wimmera soils when seasonal conditions are favorable.

Twelve different manurial applications were tested side by side, and the yields for the past year ranged from 36 to 54 bushels per acre. These yields are in remarkable contrast to those of 1914, when, owing to the drought, the yields from a similar series of plots varied from 2 to 7 bushels per acre.

The results for 1915, together with the average yield for the past three years, are summarized in the following table:—

Treatment.	Yield per acre, 1915.	Average yield for 3 years, 1913-15.
	Bushels.	Bushels.
1. No manure	37·53	19·32
2. Superphosphate, ½ cwt.	49·44	26·73
3. Superphosphate, 1 cwt.	51·33	28·77
4. Superphosphate, 2 cwt.	54·72	30·16
5. Superphosphate, 1 cwt., lime, 5 cwt.	52·16	29·30
6. Superphosphate, 1 cwt., lime, 10 cwt.	49·80	28·92
7. Superphosphate, 1 cwt., lime, 20 cwt.	46·88	27·99
8. Basic slag, 1 cwt.	40·88	21·43
9. Basic slag, ½ cwt., superphosphate, ½ cwt.	46·08	26·71
10. Superphosphate, 1 cwt., and nitrate of soda, ½ cwt.	48·80	30·09
11. Superphosphate, 1 cwt., nitrate of soda, ½ cwt., potash, ½ cwt.	49·24	28·44
12. Farmyard manure, 10 loads	45·72	24·98

The triennial averages are especially interesting, as they indicate the manurial treatment most likely to be successful on Wimmera soils. They show that by thorough cultivation, and even without the assistance of any fertiliser, yields of 19.32 bushels per acre have been obtained. By sowing 56 lbs. of superphosphate, worth 2s. 6d. per acre, an increase of 7½ bushels per acre is obtained, giving an extra profit of 27s. 6d. per acre over the unmanured plot, with wheat at 4s. per bushel. By increasing the dressing to 1 cwt. per acre, costing 5s., an extra 9½ bushels were obtained, the net profit in this case being 33s. per acre over the untreated plot.

Heavier dressings than 1 cwt. give greater yields, but the increases beyond 1 cwt. are not remunerative.

The results also indicate that lime gives little or no response on Wimmera soils for wheat. Dressings up to 5 cwt. per acre increase the yield, but the increase is insufficient to pay for the extra cost of the lime. Heavier dressings than 5 cwt. per acre depress the yield. This is in striking contrast to results obtained in the north-east, where the application of lime has resulted in substantial and profitable increases in yield.

Basic slag is apparently less efficient in the Wimmera than in any other part of the State. The marked superiority of superphosphate over basic slag at Longerenong is probably due to the relatively high lime content of the soil.

In common with tests at other centres, the application of nitrates and potash do not result in profitable increases. It is a fortunate circumstance for the Victorian farmer that even on the oldest cultivated wheat areas experiments show that costly nitrogenous and potassic manures, so indispensable in European farming, fail to elicit a material response from Victorian wheat soils.

It is interesting to note that the plot which gave the highest net profit per acre for the three years was treated with 1 cwt. of superphosphate. As the average amount of super. used in the wheat areas is between 60 and 70 lbs., the test suggests that if heavier dressings of this fertiliser were generally used a material increase in the wheat output might be expected.

TIME OF SOWING AND RATE OF SEEDING TESTS—WYUNA.

An illustration of the effect of early and late sowing and the rate of seeding on the yields of wheat in the Northern areas is afforded by the results of experiments conducted at the Wyuna State Farm in 1915. The variety of seed used was Federation, a wheat of moderate stooling powers, and in the tests quantities of seed varying from 30 to 120 lbs. per acre were sown early in May and in the middle of June. The results were as follow:—

EARLY SOWING (First Week in May).

	Bushels per acre.
Plot 1, 30 lbs. per acre	31·4
Plot 2, 45 lbs. per acre	34·5
Plot 3, 60 lbs. per acre	36·6
Plot 4, 75 lbs. per acre	35·8
Plot 5, 90 lbs. per acre	34·7
Plot 6, 120 lbs. per acre	33·2

LATE SOWING (Middle of June).

Plot 7, 30 lbs. per acre	28·8
Plot 8, 45 lbs. per acre	27·3
Plot 9, 60 lbs. per acre	31·9
Plot 10, 75 lbs. per acre	34·0
Plot 11, 90 lbs. per acre	35·3
Plot 12, 120 lbs. per acre	32·1

The season was very mild and favorable to crop growth, and the difference between the early and late sown crops was less marked than usual. The rainfall during the growing period was 12.75 inches. It will be seen that even in a favorable season early sowing has considerable advantages. The highest return from all plots—36.8 bushels per acre—was obtained by sowing at the rate of 60 lbs. per acre early. If heavier seedings are used the yields rapidly fall off. With the late-sown crop the maximum return was 35.3 bushels per acre, but to get this no less than 90 lbs. of seed had to be used. The early sown plots gave greater crop returns and required far less seed than the late-sown plots. Precisely similar results were obtained at other centres. The results also suggest the reason for increasing the rate of sowing towards the close of the seeding season.

VARIETY WHEAT TESTS—MALLEE.

Results of the variety wheat plots conducted by the Department of Agriculture in the north-western Mallee are to hand. The centres chosen were Ouyen and Cowangie. At Ouyen six varieties of wheat were tested side by side on the farm of Mr. H. W. Pickering. The results were as follow:—

	Bushels per acre.
Yandilla King	20
Gluyas	17
Federation	16½
Dart's Imperial	16
Viking	13½
Marshall's No. 3	13

At Cowangie the tests were carried out by Mr. H. F. Hecht, and seven varieties of wheat were tested. The results are as follow:—

	Per acre. bus.	lb.
Dart's Imperial	25	52
Yandilla King..	23	19
Federation	23	4
Marshall's No. 3	22	20
Gluyas	20	23
Mac's White	19	22
Viking	16	21

Generally speaking, the late maturing varieties, such as Yandilla King, have done best at both centres, and this is doubtless due to the prolonged cool weather in spring and early summer favouring the development of these slow-growing types. It is interesting to note that Mac's White, one of the most popular varieties in the north-west Mallee, occupies a relatively low place on the list. Gluyas has done best of all the early maturing wheats, and at Ouyen its yield exceeded that of Federation. At both centres the yields of the early varieties were affected by a severe frost, followed by a hot wind. The rainfall during the growing period at Ouyen was 8.93 inches, and at Cowangie 10.32 inches. In both cases the plots were grown on land that had been cropped previously. The yields at both centres are a striking testimony of the fertility of the Mallee areas in a normal season.

(To be continued.)

AMERICANS AND FRUIT.

America is quite ahead in the matter of fruit eating. In fact, it consumes more fruit per head of population than any country in the world. This is due to several reasons—first, the progressive methods of advertising adopted by the various packing organizations; and, second, by the excellent manner in which the various cafés, restaurants, and other eating-houses display the fruit. On entering any of the ordinary eating-houses the first thing that attracts is a pyramid of beautiful apples arranged either on the counter or in some conspicuous position, also grape fruit, oranges, and other fruits. This excellent feature is noticeable in all the leading cities, San Francisco, Los Angeles, St. Louis, Chicago, &c. Fruit is placed under the attention of the public on every opportunity.—*Auckland Weekly News.*

A LESSON ON THE DROUGHT.

By B. A. Barr, Senior Dairy Supervisor.

If cows receive only sufficient fodder to keep them alive no return for the feed is received beyond the prospective value of the cattle, whereas, if sufficient is given to provide for milk production in addition to that required for maintenance, a profit over the cost of feed will be returned, provided always the cows possess milking capacity. The following case illustrates the value of feeding milking cows with a full ration, even at the high prices ruling for feed during the past drought. A herd of twenty-nine cows, including five heifers on first calf, and cows in all stages of lactation, each received as a daily ration:—

	s.	*d.*
8 lbs. straw chaff valued at £6 per ton cost ...	0	5.1
8 lbs. bran valued at £11 per ton cost	0	10.4
2 lbs. cocoanut oil cake valued at £12 per ton cost	0	2.6
Total cost for each cow	1	6

The return was as follows:—

Daily yield, 61 gallons at 1s. 3d. per gallon on railway station.

	s.	*d.*
Daily average return for each cow	2	7
Daily average cost of feed	1	6
Profit	1	1

The straw chaff was steamed, and had been on the farm for some years.

The farm was in a drought-stricken area, the paddocks were bare, and this return was received throughout the whole drought. If the milk had been used for butter-making a profit of 4d. per day would have been returned. Supposing the food provided had been reduced to an amount sufficient only to keep the cows alive, no profit would have been returned, but instead a charge for cost of feed would have to be made against the value of the stock.

The above ration is considered neither an ideal one, nor the most efficient, but it must be remembered that, at the time, drought conditions prevailed, and bulky feeds were particularly scarce. Under normal conditions, or when purchasing even in drought times, hay chaff at high rates would be preferable to straw.

SCIENCE and practice helped by experience—that is what we want. Experience means that which we have ourselves learnt; that which has been knocked into us so forcibly is never forgotten. This is why it is so often advocated that "every farmer should be his own experimenter."

THE WALNUT.

(Continued from page 747, Vol. XIII.)

C. F. Cole, Orchard Supervisor.

DISEASES (*concluded*).

BACTERIOSIS OR WALNUT BLIGHT.

Of all known diseases attacking the developing nuts of the walnut, bacteriosis is the worst that the grower has to contend with. The loss caused by this bacterial trouble is considerable, and has been mentioned in former articles (*vide Journal of Agriculture*, August, 1914, p. 460).

It is not definitely known how long this disease has been in Victoria. Mr. C. C. Brittlebank, Vegetable Pathologist to the Victorian Department of Agriculture, states that he saw walnut trees growing upon a farm in the year 1888 attacked. Mr. J. Farrell, Supervisor of Orchards, submitted in November, 1906, diseased walnuts from the Ardmona district to Mr. D. McAlpine, the Government Vegetable Pathologist, and he diagnosed the trouble as walnut bacteriosis. From inquiries made, several growers in the Bright and adjacent districts state that they have known the walnuts to be attacked from twelve to twenty years ago by a disease which they commonly termed black spot. There is no doubt that this black spot of twenty years ago is the bacterial disease of to-day. Up to the present in Victoria there is no record of the fungus disease (marsonia juglandis) appearing. This produces a similar condition to that of walnut bacteriosis.

From personal observations and the perusal of scientific works dealing with this disease, it is found to be more prevalent and virulent in localities where the weather conditions are moist and humid during the spring and early summer than in districts where such weather conditions do not prevail.

In Victoria the greatest quantity of walnuts is produced from trees growing in districts having a good annual rainfall and subject to moist atmospheric conditions in late spring. Therefore, the walnut crop is partly looked upon as a chance one, owing to the risk of attack by this bacterial organism.

During the month of November, 1913, in the Bright and adjacent districts the walnut crop looked promising until moist and humid conditions set in. By the end of the month the greater percentage of the developing nuts was attacked or destroyed by bacteriosis.

The following spring and early summer of season 1914 was one of the driest upon record in these districts. The walnut crop was almost entirely free from attack.

Trees that lost fully 75 per cent. of the crop through this trouble in the spring of 1913 were practically free from attack in the dry season of 1914.

Official Record of Rain, Bright District, for the Last Three Months in the Years 1913-1914.

1913.	Inches.	Points.
October	4	31
November	2	98
December	1	07
1914.		
October	—	—
November	1	98
December	2	72

This shows that the development of this bacterial organism is influenced by the same atmospheric conditions as largely controls the development and growth of fungus diseases generally. Although prevalent in the walnut areas of the State, and commonly termed black spot, very few growers know that the actual cause of this walnut disease is

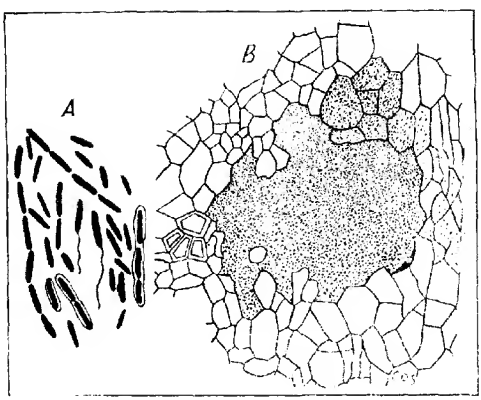


Fig. 32.—A. Walnut Blight Organism (Pseudomonas juglandis) greatly enlarged. B. A mass of the bacteria in diseased walnut tissue. (After Smith, Bulletin No. 231).

the workings of a bacterial germ. Bacteriosis of the walnut is a micro-organism, rod shaped, having rounded ends, and occurs as a single rod or often in pairs, and more rarely in chains of several individuals, commonly four to eight. An American authority gives the measurement of these rods as found in diseased tissue from 1.5 to 3.01 microns in length by 0.3 to 0.51 microns in width. A micron is the millionth part of a metre, or 1/25400 of an inch. (Plate 32.)

This blight organism is motile, *i.e.*, capable of spontaneous motion, increasing rapidly in number by elongation and division, or fission.

Walnut bacteriosis does not confine its attack solely to the developing nuts. It may occur upon all the tender, new, growing parts of the trees, such as young nuts, branches, and parts of the foliage. On the affected parts blackish-coloured areas, or pronounced lesions (wounds)

are produced. Vegetable pathologists state that this blackening is brought about by oxidation of the tannic acid in the tissue.

Very little having been done in Victoria with regard to the physiological and pathological characteristics of this disease, the following abridged extracts are from Bulletin No. 231, an American work already referred to, and are the results of exhaustive scientific experiments, both in the laboratory and field.

Cause of Disease.—This disease has been conclusively proved to be produced by a species of bacteria growing in the diseased parts. A microscopic examination of diseased tissue shows countless numbers of these small, rod-shaped organisms to be present. By employing bacteriological methods pure cultures of these germs were obtained, and then these pure cultures were used in making artificial inoculations into healthy nuts and shoots, thus again producing the disease by inoculations from the culture if the tissue was in an active growing condition. This disease causes very characteristic, comparatively small, sunken black areas on the small shoots of the trees. It does not attack branches of any size, and does not injure them to such an extent that they die back for several feet, as in the case of a trouble termed die back, which is principally caused through a dry subsoil, planting the trees too closely together, deficiency of plant food, and other causes. Although bacteriosis attacks the leaves, it does not cause defoliation of the trees, and if this disease did not attack the nuts would be of little economic importance. Young trees are much more free from bacteriosis than are those that have been in bearing for a longer time.

On Branches.—Bacteriosis is at first confined to small areas, but under favorable conditions these increase in size to a lesion or diseased area, extending 2 or 3 inches in length on the green shoot. The disease always has its beginning on the young succulent growth which may be near the growing end, or at any other point. When the disease infects a branch near its end, that part may be killed back, but this seldom occurs except when the diseased lesion is very near the end. In the worst diseased lesions the tissue is killed inwardly to the pith, while in less severe cases only the bark and wood are diseased. As the shoot becomes more woody it is more and more difficult to infect, and no tissue ever becomes affected after the first few months of its growth. The disease, after the first year, even in well-defined lesions, gradually dies out, and the tissue heals over the old lesion, although in some cases short lengths of the worst diseased shoots may die back for a few inches. The diseased portion on the twig at first forms a small, discoloured, or water-soaked area, which gradually increases in size, and at length the central portion becomes black, and is surrounded by a water-soaked margin, or fermentation zone. As the shoots become more and more woody, the active development of the disease is checked, and no further tissue is involved. Then the whole diseased area becomes blackened in colour. The diseased portion, in many cases, comes to have a somewhat shrunken, dried out, deformed, cracked condition, because of the killing and drying-out of the tissue. The diseased twigs of the previous year are without doubt the chief source of the initial infection each spring.

The catkins are probably not diseased by walnut bacteriosis; they often turn black, but this is probably only due to the natural process of

dying and drying up after their work is done. Various attempts have been made to obtain the blight organism from these darkened catkins, but without success.

Blossom End Infection.—While the nuts may be infected at any point in the surface, by far the most common, as well as most virulent form of infection is at the blossom end, near what is technically called the stigma. This is the weakest part of the nut, and is especially sensitive to the blight. The bacteriosis is very bad on the small nuts, and when once it has started at this point it rapidly continues its growth within the tissue, until the small nut is sufficiently weakened to fall. Not all the infected nuts fall when they are small, but some remain on even until harvest time. In the nuts the disease gradually grows within the tissue until the kernel is reached, which at length becomes blackened and then destroyed. The disease may start at any place on the nut, and gradually

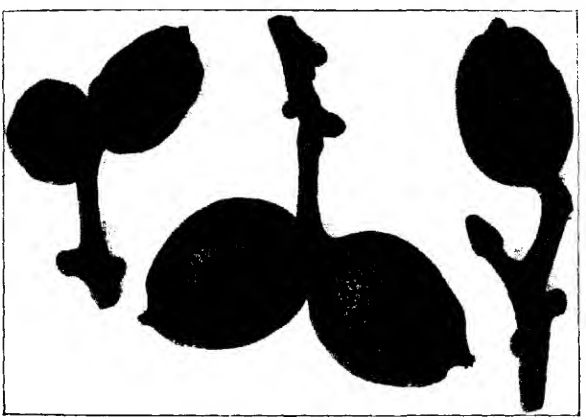


Fig. 33.—Developing walnuts attacked by bacteriosis—Bright district, 1913.

extend through other tissues into the kernel, but by far the most of the infections that injure the kernels are from the blossom end. (Plate 33.)

Lateral Nut Infection.—The disease on the nuts starts at one or more points on the surface as a small, circular, raised, discoloured area that at first has a water-soaked appearance, and may not be larger than the point or head of a pin when first visible. The diseased area in its earliest stages is slightly raised above the surrounding healthy tissue, but as the disease progresses the spot becomes more or less sunken below the normal tissue. The spot gradually enlarges in size, and becomes black in appearance. Surrounding the blackened area is a paler zone, having the same water-soaked appearance already referred to. This band of tissue lies between the healthy tissue and the blackened area, and represent the cells of the tissue that are being acted upon by the ferments secreted by the organism, which break down the tissue and

prepare the way for the further advance of the bacteria. In the early infections, if climatic conditions are favorable, lesions, or dark spots, are formed, which often extend through the hull and shell-forming tissues into the kernel. The nut in such cases is deformed in shape as the diseased part ceases to grow. Such nuts do not bark clean, as the outer covering clings very tightly to the shell, and the kernel at best is only poorly developed.

Late Infections.—It often happens that during the summer months weather conditions are favorable for natural infection of nuts. At this time the outer tissue is beginning to harden, and is not in condition for the deep growth of the disease that occurs earlier in the season, when the tissue is more tender. The parts of infection appear as small, dark-coloured areas scattered over the surface of the nut. Each little infection can be distinctly seen, or its confluence with others may make a large spot. In these late infections the development is shallow, and does not penetrate much through the epidermis, and the disease seems to dry out and die. Occasionally a more severe late infection occurs, where the blackening and lesion extend to the hard shell, causing the hull to cling to the shell of the nut.

White Deposit on Diseased Tissue.—On the surface of the diseased tissue of both the branches and the nuts can often be observed a whitish substance that accumulates during the summer, but at length disappears. When this is properly stained and examined with a compound microscope, it is found to be composed of countless numbers of bacteria and broken-down plant tissue.

Winter Habitat of Germ.—The germ of the organism, without question, winters in the old lesions of the branches. Much work has been done in making cultures at short intervals of time throughout the year from the different diseased tissues in order to see if the disease organism was alive, and where it best could pass through the winter, or dormant period. In every series of cultures the disease organism was found, showing conclusively that the disease was still alive in the old lesions of the wood and bark. The most prolific source of new infection is the lesions on diseased twigs. Here the germs remain in almost a dormant condition until the warm weather of spring, which arouses them to a renewed activity, when they exude on the surface, and are carried to the new growth, leaves, branches, and nuts. From observation, the young leaves seem to be infected very early, and probably are one of the chief sources of the secondary infection.

Secondary Infection.—The first, or initial infection, may occur on only a few nuts and new growth, then quite suddenly the disease seems to spread and infect many small nuts. This sudden increase of the disease is due to an infection from the earlier diseased nuts and new growth, and can thus be termed the secondary infection.

Effect of Climate.—This disease is quite susceptible to variation in climatic conditions. It is a matter of observation that the amount of disease varies from year to year in a given locality, also that some sections are freer from the disease than are others, even during the same period of time. A grove may be very bad one year, and nearly free from the disease the following year. The amount of moisture present in the air has, without question, considerable influence on the quantity

of disease that may develop, as humid conditions are especially favorable for its spread. It has been proved again and again by experiments that infection is produced when water containing the disease germs is sprayed on the surface of the young nuts, while the untreated ones are free from the disease. Then, for infection to take place under natural conditions, it only becomes necessary for virulent germs to come in contact with immature nuts, and water is apparently the principal agent in conveying the germs from the diseased lesions to the young growth or small nuts below. Rains or fogs occurring in the spring, after the nuts appear, particularly at night, are very favorable for the dissemination and new infection of the small nuts. During these conditions the trees become saturated, water dripping from one portion of the tree to another, which could easily carry the disease organisms to healthy tissue.

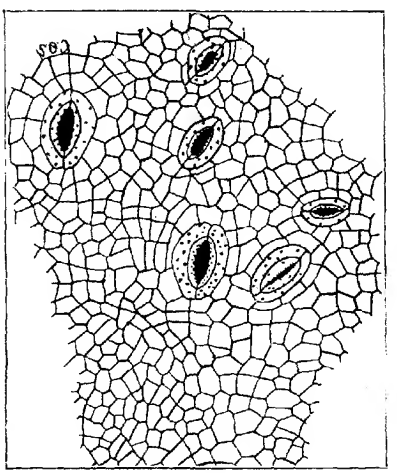


Fig. 34.—Section of surface of green walnut, showing a group of stomata through which the blight germs enter. Much enlarged. (After Smith, Bulletin 231.)

How the Germ Enters the Tissue.—Nuts, as well as the leaves and young shoots, are provided with stomata, or breathing pores, through the epidermis into the interior of the tissue. These stomata on the nuts are arranged in groups of from five to a dozen or more, and are to be found on the paler green specks that spot the surface of the husk of the green nuts. It is through these openings that the bacterial organism can gain entrance to the interior of the tissue of the young nuts. The blight organism being motile and when carried to the surface of the nut by moisture, such as fogs, heavy dew, and rain, can use this moist surface to swim directly into the stomata, or breathing pores, just described. When once in the interior of the nut, the conditions are

favorable for further development. While these stomata have the power to open and close, they are probably never so closely shut that the small germs could not enter. The moist conditions favorable for the entry of the germ, or bacterium, through the stoma are also just the conditions necessary for keeping this entrance open.

Non-blighting of Late Blooming Trees.—The majority of the bearing groves of California are at this time year 1908 seedling trees, differing greatly in their blooming periods. The difference in time is frequently from one to two months, and may be as much as three months between the earliest and the latest French varieties. Such a wide range in time of blooming gives considerable chance for difference in climatic conditions. We find that the early or medium blooming trees are in blossom at a favorable period for the blight to develop, while the late bloomers come into flower at a time when bacteriosis can make little headway. Particular attention has been given to this phase of our investigation, in the hope of finding a commercially profitable tree that blooms at a season when conditions for the infection of the small nuts is at a minimum. While this work is not yet completed, enough has been done to show that nuts in such late trees are comparatively free from the disease.*

Immunity.—Certain trees are some times spoken of as being immune to the blight, but while there is probably no such thing among walnuts as absolute freedom from this disease, where conditions are favorable for blight infection, yet some trees do show quite a marked resistance, and, if otherwise desirable, are given precedence in new plantings on this account (variety Eureka, for instance). It may be that in certain localities there is no blight, but this probably is not due to any immunity that the trees possess, but is rather the effect of climatic conditions, or due to the fact that the specific organism has not yet reached this particular locality.†

Spraying to Control Bacteriosis.—American experiments.—In the spring of 1906, several large blocks of good-sized seedling trees were selected for this purpose in the vicinity of Whittier, and spraying operations were commenced. The principle experiments were made with three different fungicides—Bordeaux mixture, lime-sulphur, and a sulphur spray made by boiling together sulphur and caustic potash. The work was done with a power sprayer, and was carried on more thoroughly and carefully than any grower would be likely to do such spraying, and without regard to expense. In one instance a large block of trees was sprayed with Bordeaux mixture, using a 5.6.50 formula; in another, a heavy lime-sulphur was used, the spray being prepared by boiling; while in the third the potash-sulphur spray mentioned above was used. It was found in all this work that to spray large walnut trees thoroughly is an extremely slow, difficult, and expensive operation. As a result of this experience we were led very soon to believe that the general spraying

* Probably this lateness in blooming is responsible where trees are found reasonably free from attack, and growing adjacent to those very susceptible. The majority of walnut trees in Victoria originated from non-selected seedling trees, and start to bloom early, from the latter end of September and during October. Any trees found blooming towards the end of October and early November should be comparatively free from this disease. If this lateness of blooming is an important factor such trees should be kept under observation by the grower, and compared with the early bloomers.—AUTHOR.

† No doubt these conditions are responsible for the immunity of trees growing in certain localities in Victoria.—AUTHOR.

of Californian walnut groves would be extremely difficult, if not absolutely impossible, for the average grower to get the work done thoroughly enough, even though the spraying done by ourselves should prove extremely effective in controlling the disease. During the summer following our sprayings careful observations were made from time to time of the conditions as to blight of the sprayed and unsprayed trees in the experimental orchards. From such observations no difference whatever in the prevalence of the disease on the nuts could be detected. Many of the sprayed trees lost a large portion of their crop from bacteriosis, and even on individual, rather small trees, or individual branches which had been especially well sprayed, and absolutely covered with the mixture, much blight developed on the nuts, and it soon became apparent that no satisfactory degree of control, if any, had been secured by our work. During the following year, 1907, the appearance of the trees sprayed in 1906 gave some reason to believe that the disease was less prevalent on the sprayed than on the unsprayed trees. This was particularly true in the case of trees sprayed with lime-sulphur. It is, therefore, not improbable that while infection of the nuts during the year when the spraying was done was not prevented, that the shoot and twig infection was somewhat controlled, and that on this account less blight was carried over winter, and less nut infection took place the following year. From the experiments, we became thoroughly convinced that the possibilities of walnut bacteriosis control did not lie in the direction of spraying.*

* The results of spraying in Victoria gave no satisfaction as regards controlling this disease. Furthermore, it is not a practicable proposition owing to the size the trees attain under favorable conditions.—Author.

NITROGENOUS NODULES.

The majority of plants do not have root nodules, as, for example, the cereals, potatoes, and the like. The nitrogenic nodules are produced by micro-organisms closely related to the bacteria, which make their entrance from the soil through the tender walls of the younger portions of the roots, and induce a cell growth in the region of the invasion that results in a nodule, which is able to lay hold and adapt the free nitrogen of the atmosphere for the use of the plant. To a certain extent the number and size of the nodules may be taken as an index of the success of the plant. Soil from an old pea field will produce nodules upon pea roots in new land better than upon clover or any other crop. This leads to the subject of soil inoculation. Successful experiments have been made in soil inoculation with crimson clover and hairy vetch. Soil from old pea land has made a striking difference when spread upon other soil, and the larger growth and deeper green colour of the pea plants. Soil in which peas were grown in one district has been brought to another for inoculation, and the nodules formed in this mixture were afterwards used to inoculate other soils. Besides this also the growth of leguminous plants in rotation with cereal crops fulfils another important function in the promotion of humus on the surface soils.

THE PRACTICAL ECONOMY OF SKIM MILK.

By J. M. Kerr, Senior Dairy Supervisor.

Every gallon of cream sold, leaves on the farm about nine times its own bulk of separated milk to be turned to other account. The use to which skim milk is most commonly put is conversion into bacon by feeding to pigs; but it is rare indeed to find it being used as economically as it might be in the process. This is mainly due to a defective understanding of its limitations, in which case the discredit which is so often visited on the skim milk should really attach to its owner. Properly understood, and properly utilized, skim milk has a value which no ordinary dairyman can afford to despise.

WHERE FAT'S COMMON VIRTUE DOES NOT APPLY.

In utilizing skim milk, it should never be forgotten that the natural fat is missing, and that, in consequence, skim milk alone is a one-sided food for any animal. As it happens, skim milk retains the most valuable food ingredients, the loss of fat notwithstanding. From the bacon-curer's point of view, fat is the ingredient which can best be spared. In animal nutrition, fat shares with starch the function of generating the requisite heat and energy, though of the two, fat is much the more efficient for the purpose. This gives fat a very high value in most feeding operations, but feeding for bacon production is the exception.

An animal warmly-kept, and at rest—as a fattening pig should be—need consume but little heat-producing (carbohydrate) ingredient to satisfy all its needs in that particular direction. If these needs be much exceeded, nature, being unable to utilize the surplus heat and energy, conserves them in the system, in the form of fatty tissue, to a degree inconsistent with the popular taste in bacon. It not only means an excessive proportion of fat to lean, but, if the diet be too fatty, the bacon so produced is poor also in colour, flavour, and keeping quality. For this reason, the heat and energy supply of a pig may well be entrusted to the less active carbohydrate—starch—a food ingredient which exists to superfluous extent in most foodstuffs commonly available on the farm.

SKIM MILK AN UNBALANCED RATION.

A food to be complete must possess two distinct groups of ingredients. One group is represented by fat and starch, which have a common function which, in the case of a restful, comfortable pig, might be called fat formation; the other is protein, which has a different function, viz., mainly flesh formation. In a perfectly-balanced diet, these two classes of food must exist in a certain ratio to one another—the nutritive ratio. Any departure from this relation, one way or the other, is a detriment. As the solid portion of whole milk contains the respective food groups in just ideal proportion for a growing animal, neither part can be depleted without leaving the other superabundant in consequence. It is because the butter-fat is missing that the remaining solids contain such a high percentage of protein in fact too much protein.

THE HIGH PROTEIN CONTENT PARTICULARLY VALUABLE.

This is a rare virtue in foodstuffs, and the dairy farmer who fails to appreciate its significance in animal feeding does not know his business.

The man who knows what protein means to a ration also knows the difficulty of procuring it in adequate quantity. No doubt the water, existing in such quantity as it does in skim milk, is rather a debaser—in cold weather, at all events; but the man who would complain of the excess of protein is surely suffering from an embarrassment of riches.

Protein, and particularly digestible protein, is the ingredient in which nearly all the common home-grown foodstuffs of the farm are more or less deficient, and it is really the chronic want of a sufficiency of it which generally embarrasses dairy farmers in all their animal-feeding operations—if they only knew it. It is just here where skim milk, with its more than enough protein, can be put to its utmost practical use. Skim milk contains practically all the natural protein of the milk, as well as the milk-sugar and mineral matter. Just as protein is indispensable for flesh formation, mineral matter is equally so for bone formation. These two formations—flesh and bone—constitute real growth in the animal, as distinct from the mere accumulation of fatty tissue. It should be every bacon-producer's care to so feed his animals that fat formation waits on flesh formation, and good bacon on both. This cannot be accomplished without adequate protein and mineral matter—the peculiar virtue of skim milk.

In no other food in nature does either protein or mineral matter occur as assimilable and as palatable as in the curd and ash respectively of milk—either whole or skimmed. In having a feeding material of such nature daily to his hand, the dairy farmer is certainly in a favoured position as a producer of prime bacon. It calls, however, for proper use, viz., that of balancing other fodders not so plentifully endowed with precious protein.

Excess of any Constituent Means Deficient Consumption of Another.

The mere presence of protein, fat, starch, and mineral matter in a food is not enough—a further necessity is that they be present in proper proportion. Skim milk's one-sidedness is due to its excessive protein-content and the comparative deficiency of carbohydrate: but another imperfection which must also be allowed for is the water content—superabundant, yet dissociable—which unduly adds to the bulk.

If skim milk alone be the pig's portion, his stomach becomes fully distended long before he has acquired a sufficiency of starchy ingredient. Over-gorging is the only alternative to going deficient—neither of which is ever associated with maximum returns. Some farmers foolishly think that, by souring the milk and discarding the whey, they are getting rid of the surplus water only. This is a serious mistake, because the water removed in this way takes along with it the milk-sugar—the starchy ingredient in which the skim milk is already deficient.

The Rational Method of Balancing by Addition.

Extraction of the surplus water is not commercially practicable, and would be folly to attempt, seeing that the same desired effect can be arrived at by supplementing the milk with other foodstuffs over-rich in starch (to balance the surplus protein of the milk solids) and as free from water as possible (to balance the excessive water-content of the milk). The ideal "thickening," therefore, for skim milk, should be the

more starchy and dryer grain concentrates, viz., maize, wheat, barley, &c., and pollard, which, though fattening in themselves, have a higher proportion of starch to protein than is required, and only need a little more of the latter to make them about all that a pig requires in the way of food—that is, if adequate water is also provided. Skim milk is admirably adapted to supply the little which grain lacks; and, because the deficiency is little, it can be fully met by an amount of skim milk not beyond the pig's capacity to absorb. If any more than 3 lbs. of skim milk is fed to each pound of grain, the farmer may depend that the pig's progress is being hampered for want of sufficient starch. This ratio should never be exceeded, even in a young, growing pig, in which the demand for protein and mineral is much greater than in an older one. As the pig develops to full size, the proteid skim milk should be still further reduced, even eventually down to the pound-to-pound ratio. Provided normal prices prevail, the pig will repay with interest every pound of pollard so used.

THE ADVANTAGE PROVED.

So far, we have the theory, but it does not stop at that. We have the experience of many of our most successful pig fatteners, as well as the authority of leading experimentalists, to show that it is borne out in practice. The experiments about to be quoted speak in pounds, but most pig feeders are not exact enough in their practice of mixing foods to be able to say what weight of each foodstuff their pigs receive. It is safe, however, to accuse the majority of never adding as much as a bucketful of pollard to a bucket of skim milk. Yet this is not enough pollard—it is but 1 pound in 4. The pig's needs call for never less than 1 pound in 3.

THE SUPERIORITY OF THE HIGHER PROPORTION OF GRAIN.

The mutually economizing effect of grainstuffs and skim milk, when fed to the same animal in proper proportion, may be realized by a study of the following figures—the results of various experiments by Professor Henry.

To fully appreciate them, it should be understood that, when pigs received grain alone, about 500 lbs. is required to increase their weights 100 lbs.; and that about 3,000 lbs. of skim milk, if fed alone, will accomplish the same increase. The following oft-quoted table (from *Henry's Feeds and Feeding*) shows the respective quantities of skim milk and corn (maize) meal required to increase the weight of pigs 100 lbs., according as the milk is supplemented in greater or less proportion.

When fed	Feed for 100 lbs. of gain.	
	Meal.	Skim Milk.
	lbs.	lbs.
1 lb. of maize meal and 1–3 lbs. of skim milk ..	321	585
1 lb. of maize meal and 3—5 lbs. of skim milk ..	265	1,048
1 lb. of maize meal and 5—7 lbs. of skim milk ..	250	1,434
1 lb. of maize meal and 7–9 lbs. of skim milk ..	207	1,616

The most effective proportion is here proved to be the 1 to 3, when 321 lbs. of corn and 585 lbs. of skim milk produced the 100 lbs. of gain. Had the pigs been confined to the 321 lbs. of grain, the increase (allowing 500 lbs. for 100 lbs. of gain) would be 60 lbs. If limited to the 585 lbs. of skim milk alone, 19½ lbs. of gain might be expected. Fed in this way, the total production is 79½ lbs. Yet these same amounts, when the pigs were allowed to receive both meal and milk, produced 100 lbs.—a 20-lb. greater return without any extra cost. The improved result should be the common experience of every bacon producer who is fortunate enough to have skim milk, and none should be satisfied with less.

The Enhancement Effected by Proper Admixture.

A farmer content to use bare milk gets, from 585 lbs. of skim milk, a return of about 14½ lbs. of carcass bacon, which, at 4d. a lb., is worth 4s. 10d.; while another farmer believing in copious pollard can get back all the pollard cost and a further 9s. from the same quantity of skim milk. By spending 16s. for 16 bushels of pollard, to supplement the 585 lbs. of skim milk, 75 lbs., or £1 5s., worth of carcass bacon is produced, instead of the 14½ lbs. which might be expected from bare milk. Deducting the 16s. for pollard leaves 9s. clear to compare with his sceptical neighbour's 4s. 10d. To get the increased turnover, with its gross money return of £1 5s. instead of 4s. 10d., the farmer certainly had first to lay out 16s. The man who is not willing to spend this is practically accepting 4s. 10d. in preference to 9s.

What is Lost by not Going Far Enough.

So far, the comparison has been between the man who uses no concentrate and the man who uses it as liberally as it should be used. How does the man fare financially who believes in "some" concentrate only? His ratio is most probably represented in the third experiment in the above table. Here the pigs were fed 250 lbs. of concentrate, along with 1,434 lbs. of skim milk—about 1 in 6. The gain was the same, 100 lbs., or 75 lbs. of carcass bacon. Therefore, 585 lbs. of milk—the amount used in the best-balanced experiment—and 102 lbs. of concentrate, the same ratio, would produce 30½ lbs., or 10s. 2d. worth of bacon. From this, 5s. 1d. must be deducted for the 102 lbs. of pollard. The result is 5s. 1d. clear. The additional value imparted to skim milk, by proper balancing, is summarized in the following:—

Milk.	Pollard.	Bacon Produced.	Value.	Cost of Pollard.	Profit.	Return per Gallon.
585 lbs.	nil	14½ lbs.	4s. 10d.	nil	4s. 10d.	1d.
585 lbs.	102 lbs.	30½ lbs.	10s. 2d.	5s. 1d.	5s. 1d.	1.04d.
585 lbs.	321 lbs.	75 lbs.	£1 5s.	16s.	9s.	1.85d.

"Losing the Ship for a Haporth o' Tar."

By laying out 5s. 1d. where he should lay out 16s., a man gets only 5s. 1d. for every 585 lbs. of skim milk (equal to 1d. a gallon) instead of 9s. (nearly 2d. a gallon). Thus 58½ gallons of skim milk may return 5s. 1d., or 9s., just according to the business capacity of the man who has the disposal of it. No doubt, the man who gets the former return thinks he saves money by his more "careful" use of pollard. He does save 10s. 11d. on the pollard, and receives 14s. 10d. less for bacon

every time he does it. This loss of nearly 4s. occurs with a small quantity of milk like 58½ gallons. How many Victorian dairy farmers are suffering it many times over every day of their lives?

[Pollard has been substituted for the maize of the American experiment, because in normal times prices are always in its favour here.]

The better returns when the proportion of pollard is kept up to one-third should convince any one that full supplementation of the skim milk is worth while, despite the indifference of so many dairy farmers.

Of course, it is not meant to suggest that a certain exact proportion is to be adhered to absolutely in the practical operation of pig feeding—a slight variation one way or the other is neither here nor there. What is urged is that the man with skim milk to utilize should keep somewhere near the proportion which has been proved by frequent experiment to be the most effective. It means raking in an extra 1d. for every gallon of skim milk which he is fortunate enough to possess. It may be seen from the above how the skim milk of one cow—say 585 gallons—may be worth £2 8s. 4d. to one man, and £4 10s. to another, just according to the business grasp of the owner; also, why farmers' estimates of the gallon value of skim milk vary so.

NO NEED TO GO BEYOND POLLARD.

The inducement to use concentrate in pig feeding is naturally in proportion to the net return possible from such use, and this in turn must depend on the market price of concentrates. Unless grain seconds are available instead, it is unlikely that, as a concentrate, pollard can be improved upon for the purpose; but, of course, the market price is the determining factor here. Though maize-meal, barley, rye, peas, wheat, and pollard, &c., are all nearly equally effective in fattening, it perhaps never occurs that they can be equally recommended for the purpose, because the respective prices must be considered; and the comparatively high prices which generally prevail in Victoria for most of the concentrates are a more or less constant bar to their general use as pig food. But pollard is usually a happy exception, although it is easily conceivable that beyond a certain price—as during the recent scarcity—it also would fail to be remunerative, unless the price obtainable for the fattened product should immediately adapt itself to the increased cost of production. With normal prices ruling for both pollard and bacon, a liberal use of the former with skim milk will undoubtedly justify itself, and prove a profitable venture. The other concentrates named can only be recommended in preference to pollard when their price is below normal, excepting, of course, when a man has "seconds" on hand which are not saleable. The addition of some coarser grain, however, facilitates the digestion of pollard.

WHY DO FARMERS HESITATE?

Dairymen generally do not doubt the efficiency of added pollard as an aid to fattening, and it is pleasing to admit that some supplementation of skim milk is general. The pity is that so many baulk at the quantity necessary for maximum results. A decision to purchase the requisite pollard, or to hold back more home-grown grain, requires confidence of a kind, rare amongst farmers, in the pig's ability to repay. The former means letting hard-earned cash out of hand, and the latter

means delaying the full realization of a year's labour, with an element of risk thrown in. Rather are they disposed to say, "It is not good enough risking hard cash on pigs." This is the error, and this the attitude which calls for combat. Such reasoners do not recognise the fact that, *without a liberal use of concentrate, maximum profits from skim milk are impossible.* Sometimes, of course, his financial position gives a farmer no alternative but to choose the cash-in-hand policy, and he may be a good business farmer, nevertheless—the suit has to be cut according to the cloth. But, if doubting dairy farmers, not financially restricted, will ponder what has been demonstrated by the above experiments—the reliability of which cannot reasonably be questioned—they might be induced thereby to entrust a short-dated loan to their pigs at the high interest there shown. The security may not be gilt-edged, but with pollard at 1s. per bushel, and bacon at 4d. per lb.—a very reasonable estimate—it is just as secure as that offered by committing bushels of seed oats to the weather in anticipation of a harvest. While bacon holds above 4d., and while the price of pollard, maize, barley, peas, wheat, &c., does not exceed ⅔d. per lb., a man is commercially short-sighted who does not supplement his skim milk with all the concentrate which it requires, *i.e.*, never less than 1 lb. of concentrate to each 3 lbs. of skim milk which the pig receives.

In the light of the experiments shown above, only one conclusion is possible, viz., if it pays to use concentrate with skim milk at all, it is best to use it in the most economical proportion: and when it ceases to pay in this proportion, it does not pay to use it at all. The practice of "some" concentrate is too indefinite, and is merely groping in the *dark. A closer observance of the recommended proportion might make* all the difference between failure and success in pig fattening.

Of course, it is not all. As it is only the food eaten which gives results, the farmer should make it his policy to encourage the highest consumption, without entailing gorging. This can only be achieved by frequency, regularity, and punctuality of supply in the troughs five times a day for preference. But, even with all the other essentials—healthy animals of the right class, comfortably and cleanly kept, sufficiently, frequently, and regularly fed on skim milk and concentrate—the maximum profits from skim milk will ever remain out of reach if the supplementing concentrate be used too sparingly.

Summed up, the significance of the figures quoted is as follows:—

1. That the addition of concentrate in the larger quantity greatly increases the efficiency of skim milk.

2. That the amount of concentrate commonly used with skim milk is altogether inadequate for maximum returns consequently is uneconomical.

3. That 6 lbs. of skim milk is sometimes, and 5½ lbs. frequently, spent in doing what 3½ lbs. should do.

4. That the returns possible from skim milk are much higher than are generally obtained from it.

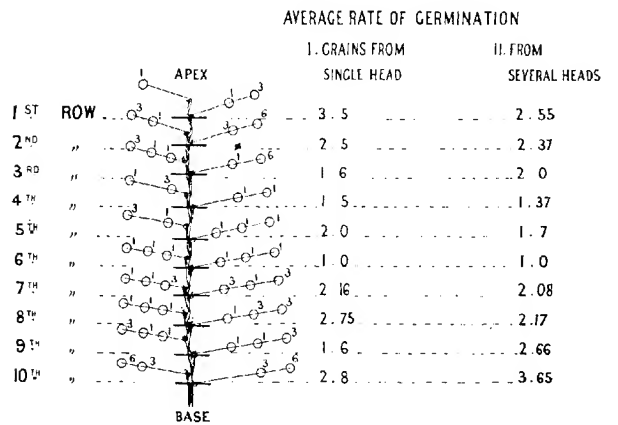
5. That *skim milk used with concentrate, never in greater ratio than* 3 lbs. to 1 lb., returns, in normal times, perhaps 2d. per gallon: whereas, if supplied in 9 to 1 proportion, the probable return is only 1d. per gallon.

The moral is, "Use plenty concentrate."

VARIATIONS IN THE PLANTS FROM THE SAME HEAD OF WHEAT.

By Alfred J. Ewart, D.Sc., Ph.D., &c., Government Botanist of Victoria, and Professor of Botany and Plant Physiology in the Melbourne University.

In 1914, Mr. Adcock drew my attention to the fact that Mr. Whelan, at Rutherglen, had observed variations in the rate of germination of grains from the same head of wheat, the more rapid germination appearing to be shown by the grains from the middle of the head. Taking single grains, however, the rate of germination appeared to fluctuate so much at different parts of the head as to render it doubtful whether the variation was real or apparent only.



Accordingly, tests were carried out at the University under fully controlled conditions in a large wire cage used for wheat breeding. Two diagrams were made on paper corresponding to each wheat head used. The grains were removed singly and planted an inch deep with the aid of a marker. The times of germination in days were marked on the duplicate diagram, those first to germinate being marked 1, those germinating three days later 3, and so on. The grains in each successive pair of right and left spikelets were marked 1st row, 2nd row, 3rd row, &c. The total germination figures were divided by the number of grains in each row. A diagram showing the germination figures for a single head is shown (Fig. 1), and also the germination averages for successive rows of a single head. (Column I of table.)

These show a considerable amount of irregular variation, but if the results from more than one head are averaged (Column II.), it can be clearly seen that the germination is most rapid in the grains of the

sixth row from the top, and that the average rate of germination decreases towards base and apex of the head. It is worthy of note that in planting out the grains in plots, none should be planted at all close to the edge of the plots, otherwise an increased delay of germination may be shown by such grains, which is due to physical causes unconnected with differences in the grains themselves.

The heads used were from a second generation cross of Federation ♂ X Bayah ♀. When the grain was ripe, the plots (thirteen in all) were examined for signs of individual variation in plants from the same head. There were no noticeable differences in the straw, flag, or in the basal parts of the heads. The tips of the heads varied, however, from somewhat tapering ends with a few distant sterile spikelets to blunter ends tipped with awns up to 1¼ inches long. The majority of the heads were awnless, the ratio being not in a simple Mendelian one, but very nearly in the proportion of 5 : 1. In three out of thirteen plots every head was awnless. In seven plots the longest awn at the tip of the head did not exceed ½-inch, and the awns were confined to the extreme tip or upper third of the head. In the remaining three plots, odd plants from various parts of the head developed awns up to 1¼ inches long, becoming shorter basally, and being always absent in the lower half of the head. All gradations between these extremes were shown, and, in addition, a similar but less pronounced range of variation was even shown in a few cases between heads stooled from the same grain.

Apparently, in this case the awned and awnless characters are not sharply defined morphological units capable of simple Mendelian inheritance, but are capable of an indefinite range of variation without any distinct line of demarcation, except such as may be made by an observer working upon a preconceived idea. In any case, it may be worth while to test the exact hereditary transmission of the awned and awnless characters more fully in a variety of cases.

POTASH FROM SEA-WEED.

The United States Department of Agriculture has made a thorough inquiry into the possibilty of using seaweed as a source of potash for the purposes of cultivation. It is known that some of the seaweeds are rich in potash. Macrocystis contains about 2½ per cent., and therefore the main question to be resolved is the cost of production. By the introduction of a machine, run on the principles of a harvester, the kelp is harvested in barges at a cost of half a dollar a raw ton. Drying in hot-air ovens is estimated to cost a dollar per dry ton. When dry the kelp is brittle, and may be ground readily. From 1,000 tons of wet kelp 86 tons of dry kelp are obtainable, and this contains 16 tons of potash, and a ton and three-quarters of nitrogen. If mixed with fish-waste manure, it becomes, by the addition of phosphorus from the latter, a "perfect" artificial manure. Estimates of cost and price obtainable indicate that there is a fair margin for profit.

BEE-KEEPING IN VICTORIA.

By F. R. Beuhne, Government Apiculturist.

XXVI.—THE HONEY FLORA OF VICTORIA—*continued.*

(Continued from page 674, Vol. XIII.)

The Butt-Butt (*Eucalyptus Bridgesiana*, R. T. Baker).

Fig. 40.

This eucalypt was formerly considered to be identical with, or a variety of, the Apple Gum (*Eucalyptus Stuartiana*). It is, however, now classed as a distinct species. It differs from *E. Stuartiana* in generally having much longer leaves, less flowers in a cluster, a whitish-grey box-like bark, instead of a red stringy bark, and a whitish-brown instead of a red-coloured timber.

It is a tree of considerable size, with a whitish-grey wrinkled, or checkered, bark, short and brittle in the grain, not fibrous, and almost identical with that of the Boxes. The bark, when freshly cut, exhales an aroma similar to the ordinary eucalyptus oil.

The sucker leaves (1, 2, 3, Fig. 40) are, in the early stage, egg heart-shaped, and then pointed egg-shaped, on stalks or stalklets opposite or alternate. The mature leaves have rather long stalks, are pointed, lance-shaped, often somewhat curved, and vary in length to over 12 inches. The leaves are not shining, the lateral veins spreading, either prominent or faint; the marginal vein well removed from the edge; the clusters on flattened stalklets carry about seven flowers; the lower half of the bud is half egg-shaped, the lid half-round, blunt or pointed. The fruit is half-round, rarely conical, on a short stalk; the rim is thickened with a ring below the edge.

The timber is fairly hard, and whitish-brown in colour. It is only good for indoor work, as it decays rapidly when exposed to the air or placed in the ground. The Butt-Butt is found in Victoria in Gippsland and parts of the north-east. (Description and illustration (Fig. 40) taken from Baker and Smith's Research on the Eucalypts.)

The Peppermint Gum (*Eucalyptus piperita*, Smith).

Fig. 41.

A tall tree, with a trunk up to 4 feet in diameter. Stem and branches covered with fibrous bark, rough and grey outside. The branchlets are slender; the leaves scattered, sickle-lance-shaped, not very long, more shining on the upper than the lower side, dark green, and usually thin; their lateral veins faint and numerous; the marginal vein somewhat removed from the edge. The umbels of from five to fifteen, rarely three to four flowers occur at the shoulders of leaves, or mostly lateral on the branchlets, on slender, slightly compressed stalks; buds on short stalklets; lower part of bud half egg-shaped, top broad, conical, pointed;

fruits usually small, globular, egg-shaped, three- or, much oftener, four-celled; fruits occasionally larger and less roundish than those shown in the illustration. (Fig. 41.)

This tree is closely allied to the Blackbutt (*E. pilularis*), the White Stringybark (*E. eugenioides*), and to the Messmate (*E. obliqua*), as well

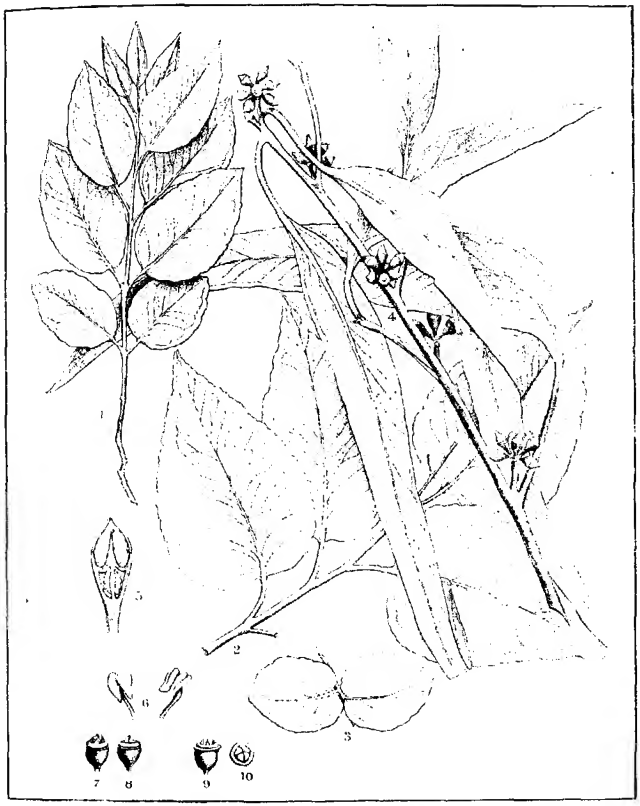


Fig. 40.—The Butt Butt (*Eucalyptus Bridgesiana*, R. T. Baker.)

[From R. T. Baker and H. G. Smith "Research on the Eucalypts, &c."]

as the Brown Messmate (*E. haemastoma*); and these different species are sometimes not readily distinguished from one another. The Peppermint Gum differs from the Blackbutt (*E. pilularis*) chiefly in its rough bark extending to the branches (which in the Blackbutt are smooth), in more slender and less angular branchlets, and smaller flowers.

From the White Stringybark (*E. eugenioides*), which was considered by Bentham to be a variety of the former, it is not easily distinguished, but its seedlings are smooth, while those of *E. eugenioides* are hairy (as shown in the background of the illustration). (Fig. 41.) The Messmate (*E. obliqua*) is distinguishable from the Peppermint Gum (*E. piperita*) by the larger and thicker leaves of the former, which are of

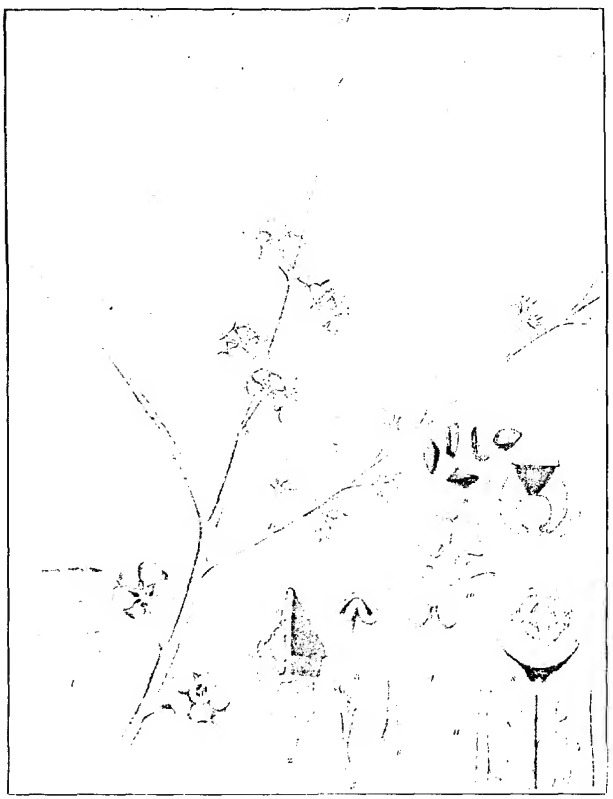


Fig. 41.—**The Peppermint Gum** (*Eucalyptus piperita*, Smith).

equal colour and shining on both sides, by the shorter and rounded blunt lid of the bud, and its longer conical lower part, or tube.

The distinguishing features of each species will become apparent on reference to the respective illustrations (viz., Figs. 41, 27, 15, 18, and 42).

The Peppermint Gum is found on less fertile areas, from the coast to the mountain region, occurring even on sand lands in Gippsland and New South Wales.

The timber is useful for posts and shingles, but inferior to that of the allied species previously referred to.

Of its value as a nectar-producing tree nothing can be said till its identity is established in districts from which information is available, but which may refer to one or other of the allied species.

The Brown Messmate (*Eucalyptus hæmastoma*, Smith).

Fig. 42.

Finally, a tall tree, with frequently quite smooth bark, or less usually persistent on the stem, but on the branches smooth to a great extent; it occurs, however, also occasionally with bark persisting up to the last branches, and would then come under the category of stringybarks, while in the ordinary form, with persistent bark on the trunk and smooth branches, it is apt, when judged by general appearance, to be mistaken for Blackbutt (*E. pilularis*), and passes under the latter and several other misleading local names.

The leaves are scattered on the branchlets, lance-sickle shaped, occasionally much narrower, but exceptionally also verging into a somewhat oval form, shining and of equal green on both sides, the veins running more with, than across, the leaf; the marginal vein somewhat removed from the edge. The umbels are mostly solitary, at shoulders of leaves, or lateral on branchlets or some in a short spray on angular and often somewhat compressed stalks, with from five to ten or rarely more flowers in each umbel. Tube of calyx (flower cup) broadly conical, about twice as long as the half-round depressed or slightly pointed small lid of the bud; the tube is not angular, and tapers into a somewhat long stalklet. Fruit half egg-shaped, with a rim of brownish-red colour, from which the species derives its systematic name, it is four, or less frequently, five-celled, the rim depressed or quite flat; valves very short.

The wood is not of any great value, not being durable, but it furnishes fair fuel. In Victoria the Brown Messmate is found in the eastern part of the State.

As closely-allied species sometimes differ considerably in the character and value of the honey produced from the nectar of their flowers, as, for instance, in the case of Yellow Box (*E. melliodora*) and Red Box (*E. polyanthemos*), what has been said in regard to Messmate Honey (*E. obliqua*), Fig. 15 (*Journal of Agriculture*, March, 1915), cannot be applied to the Brown Messmate (*E. hæmastoma*) without verification.

As to the time and frequency of flowering, and the length of time in bud of this and the two preceding species, nothing is yet known, and the writer would be grateful to get into communication with beekeepers and others interested in the Eucalypts who are able to give information, so that further and more complete data of the flowering habits of our Eucalypts may be available for publication.

The Sandal Gum (*Eucalyptus santalifolia*, F. v. M).

Fig. 43.

A tall shrub, flowering, however, already at a height of 5 feet. In sandy desert country, as also in scrubby valleys or on arid ridges, restricted to regions near the coast, and occurring in Victoria in the Portland district.

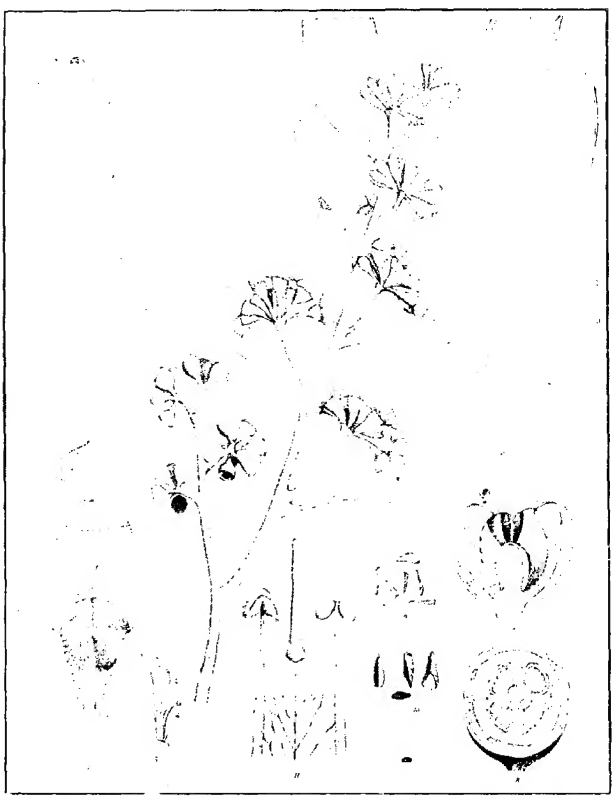


Fig. 42.—The Brown Messmate (*Eucalyptus laevinstoma*, Smith).

Leaves scattered on firm angular branchlets, thick, narrow or rarely broad-lance shaped, almost straight or somewhat curved, of equal colour and shining on both sides on moderate or short stalks; veins very faint, almost obliterated, marginal vein somewhat distant from the edge of

the leaf. The specific name was devised by some resemblance of the leaves to those of sandalwood. The umbels occur singly at shoulders of leaves, but later lateral containing three to five, or rarely six to eight, flowers; stalks of umbels scarcely or somewhat angular, the stalklets of buds and flowers extremely short or almost none; tube of flower

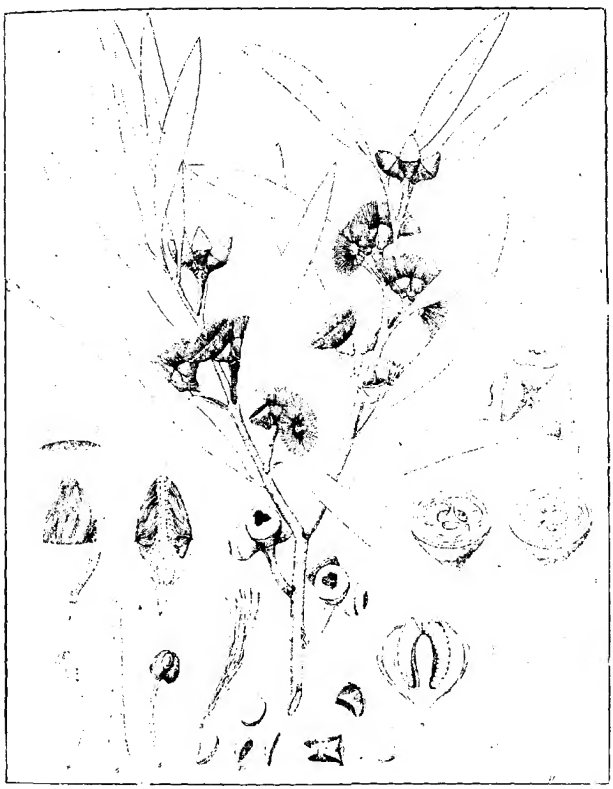


Fig. 43.—The Sandal Gum (*Eucalyptus santalifolia*, F. v. M.)

cup nearly half round and somewhat shorter than the half egg-shaped conical upper part of the bud; fruits depressed globular, three to four, occasionally five, celled. The Sandal Gum resembles the Brown Stringybark in the almost total absence of flower stalklets, but it does not attain the size of a large tree; the leaves are smaller, more rigid, of a lighter

green, less conspicuously veined, and not so unevensided. The flowers are generally less numerous on each stalk, and the fruits usually smaller. The Sandal Gum is a good oil yielder.

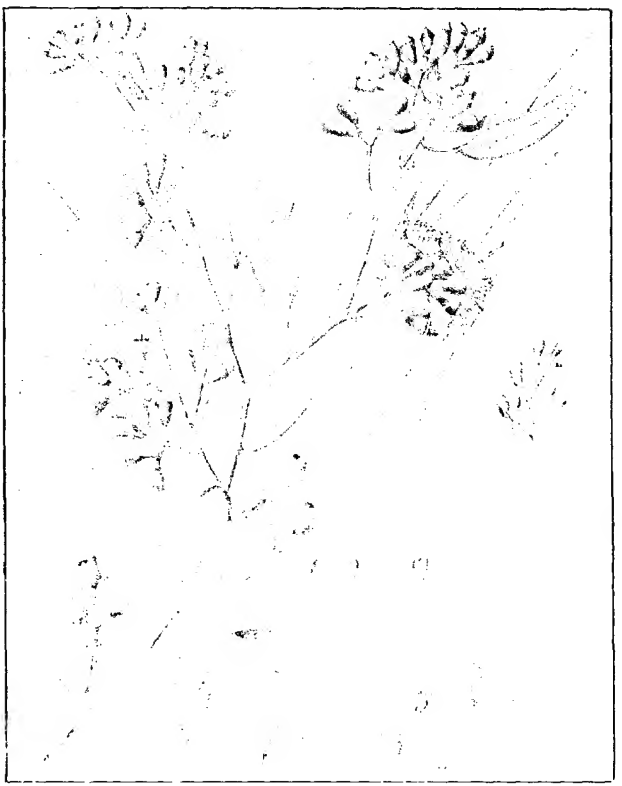


Fig. 44.—The Spotted Gum (*Eucalyptus maculata*, Hooker).

The Spotted Gum (*Eucalyptus maculata*, Hooker).

Fig. 44.

A handsome tree, with a straight stem sometimes of a length of 90 feet up to the branches, and a diameter up to 3 feet. The bark is smooth, somewhat shining, whitish or sometimes reddish-grey, mottled by bluish-white or brown-reddish spots, hence the

vernacular as well as the botanical name. Leaves scattered on slightly angular branchlets, elongated or narrow lance-shaped, often somewhat sickle-shaped, seldom more oval, of equal green on either side, more or less shining, sometimes but slightly so; their lateral veins crowded, spreading and rather prominent, the marginal vein close to the edge of the leaf. Flowers in usually short tufts, two or three together or some solitary, rarely four or more, two umbels occasionally arising from one point appearing like one, with six or seven flowers; the somewhat angular stalklets are shorter than the flower cup, the tube of which is almost half egg-shaped or slightly bell-shaped; the lid of the bud is double, the outer one half-round and pointed, the inner one depressed semiglobular, almost or quite blunt, transparent and shining; fruits globular or oval urn-shaped, with three, rarely two or four, deeply enclosed valves. The fruits vary from $\frac{1}{3}$ to $\frac{3}{4}$ of an inch in length, slightly rough or faintly wrinkled.

The timber is used in shipbuilding, wheelwright work, frame work, and street paving.

(*To be continued.*)

PURIFYING WATER FOR STOCK.

A simple method for purifying almost any water for drinking without boiling it, has been worked out by Dr. G. G. Naismith, director of the Health Laboratories of Toronto, Canada, and Dr. R. R. Graham, assistant chemist. The process is as follows:—Add a teaspoonful (not heaped up) of chloride of lime, containing about one-third available chlorine to a cupful of water. Dissolve, and add in any convenient receptacle three more cupsfull of water. Stir and allow to stand for a few seconds in order to let the particles settle. This stock solution, if kept in a tightly stoppered bottle, may be used for five days. Add a teaspoonful to 2 gallons of water to be purified: stir thoroughly in order that the weak chlorine solution will come into contact with all the bacteria, and allow to stand for ten minutes. This will effectually destroy all typhoid and colon bacilli, or other dysentery producing bacilli in the water. The water will be without taste or odour, and the trace of free chlorine added rapidly disappears.

Water containing mud in suspension is easily clarified by dropping hot wood ashes into it, or by the application of lime or alum. These two substances make the water hard. Chloride of iron may also be used. It is quite harmless, and a valuable constituent for all animals. Medical men prescribe iron in one of its several forms as a tonic. One pound of chloride of iron (2d. per lb.) will clarify 1,000 to 2,500 gallons of muddy water, and much reduce the bacterial contents.

STATE RESEARCH FARM, WERRIBEE.

Meteorological Observations.

G. S. Gordon, Field Officer, Werribee.

Summary of observations made during 1915, and comparison with previous years:—

RAINFALL.

Average rainfall for forty-two years prior to 1913	20·19 inches
Rainfall during 1913 (305 points in March)	16·43 „
Rainfall during 1914 (304 points in December)	13·24 „
Rainfall during 1915	15·55 „

EVAPORATION.

Evaporation from free water surface, 1913	46·438 inches
„ „ „ „ 1914	50·548 „
„ „ „ „ 1915	51·754 „

BRIGHT SUNLIGHT.

Total bright sunlight during 1914	= 1,906·5 hours	= Daily Mean,	5·2 hours.
„ „ „ 1915 ..	1,865·9 „	= „	5·1 „

MEAN AIR TEMPERATURES.

Year.	Dry Bulb.	Wet Bulb.	Maximum.	Minimum.
1914	59·4 F.	55·8° F.	69·6° F.	48·6 F.
1915	57·9 F.	53·8° F.	67·4° F.	47·8° F.

MEAN SOIL TEMPERATURES.

Year.	At 1 Inch.		At 6 Inches.		At 12 Inches.		At 24 Inches.	
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
1914 ..	70·9 F.	50·6 F.	63·6 F.	52·6° F.	61·0 F.	56·8 F.	160·2 F.	58·6° F.
1915 ..	72·1 F.	50·8 F.	63·2° F.	51·5 F.	60·8 F.	55·5 F.	59·9 F.	57·2° F.

MEAN OF MAXIMUM AND MINIMUM SOIL TEMPERATURES.

Year.	At 1 Inch.	At 6 Inches.	At 12 Inches.	At 24 Inches.
1914	60·7° F.	58·1 F.	58·90° F.	59·4° F.
1915	61·4° F.	57·3 F.	58·1° F.	58·5° F.

SHARE-FARMING RESULTS.

Last year an appeal was made to the farmers of the State to sow as large an area as possible with wheat in anticipation of good prices. The capacity of many wheat-growers to respond, however, was limited in many cases by lack of capital, owing to the failure of the previous harvest through drought. A number of city investors interested themselves in the extension of the wheat area, and expressed a desire to invest money in wheat growing without engaging in the work themselves.

They wanted to get in touch with men who had land but who were *without the means to secure extra plant and extra teams to put in additional* areas of wheat.

Through the Department of Agriculture a number of such farmers and investors were put in touch with one another, and arrangements made for the investors to finance additional areas sown to wheat. One investor has just forwarded to the Department a summary of the results of his investment, and in expressing his satisfaction at the result intimates that he has concluded arrangements for financing larger areas for the coming year.

The investor referred to financed 204 acres in Borung, and 500 acres in the Mallee on the share system. He paid the farmer a fixed sum for putting in and taking off the crop, supplied two-thirds of the seed and manure, and took two-thirds of the crop. The results were as follows:—

BORUNG.

Outlay—

	£	*s.*	*d.*
1. Cash advance to farmer for working 204 acres of land at £1 ..	204	0	0
2. Seed wheat, at 7s. per bushel	50	0	0
3. Two-thirds of 5 tons of superphosphate	15	10	3
4. Sacks	35	15	0
Total cost	305	13	3

Return –

Investor's share of wheat, 2,934 bushels.

MALLEE.

Outlay—

	£	*s.*	*d.*
1. Cash advance to farmer for working 500 acres of wheat at 16s.	400	0	0
2. Seed wheat and freight	74	9	0
3. Manure	25	1	0
4. Bags and freight	44	14	6
5. Cartage, 8 miles	41	2	0
Total cost	585	6	6

Return—

Investor's share of wheat, 3,744 bushels and 52 tons hay.

For a total investment of £890 19s. 9d., therefore, he has received 6,678 bushels of wheat at the railway siding, and 52 tons of hay.

If the value of the hay is placed at 30s. a ton, the total cost of the wheat to the investor would be £813, or 2s. 5½d. per bushel. His initial advance from the wheat pool, however, amounts to 2s. 6d. per bushel,

consequently whatever dividend the pool distributes will be his profit on the transaction. As the f.o.b. price of wheat is at present 5s. 3½d., he will be substantially rewarded for his enterprise. Assuming the distribution from the pool to be only 1s. 6d. per bushel, the investor will reap a net profit of £500 on an outlay of £890.

Both the farmers and the investor are satisfied with their joint operations. The farmers stated that had it not been for the investor they would not have been able to put in the extra 704 acres of land. They received cash advances of 16s., and £1 per acre, which was their estimated cost of the working of the land, and, in addition, they received for the rent of their land one-third of the crop, amounting in all to 3,339 bushels, less their third share of the cost of seed and manure.

Fresh contracts with these farmers, involving 1,000 acres of new land, have been drawn up for the coming year, and provision is being made for cultivating the land more thoroughly than was possible last season.

The above case is an interesting illustration of the manner in which financiers may assist in increasing the output of foodstuffs with advantage to themselves, the farmers, and the Empire, and the Department will be glad to again act as the intermediary on receipt of communications from those willing to invest.

VERNACULAR NAMES OF VICTORIAN PLANTS.

Continued from page 58, Vol. XIV. (10th January, 1916).

Communicated by Alfred J. Ewart, D.Sc., Ph.D., Chairman, and C. S. Sutton, M.B., Ch.B., Secretary of the Plant Names Committee of the Field Naturalists' Club of Victoria.

Botanical Name.	Popular Name.	Use or Character.
SYMPETALEÆ PERIGYNÆ *continued.*		
COMPOSITÆ.		
Vernonia—		
cinerea, Lessing	Grey Vernonia	
Adenostemma—		
viscosum, R. and G. Forster	Glandular Daisy	
Lagenophora—		
Billardieri, Cassini	Asiatic Bottle-Daisy	Of no known economic value.
Huegelii, Benth.	Coarse Bottle-Daisy	
Solenogyne—		
Emphysopus, F.v.M.	Dwarf Bottle-Daisy	
Brachycome—		
diversifolia, Fisch. and Mey.	Tall Daisy	Worthy of garden culture.
melanocarpa, Sonder and F.v.M.	Black-fruited Daisy	
radicans, Steetz	Marsh Daisy	
goniocarpa, Sonder and F.v.M.	Dwarf Daisy	
pachyptera, Turcz	Hard-fleeced Daisy	Several species might be improved by selection and cultivation, more especially B. nivalis, B. scapiformis, stricta, and multifida.
scapigera, D.C.	Tufted Daisy	
parvula, Hook. f.	Small Daisy	
graminea, F.v.M.	Grass Daisy	
angustifolia, Cunn.	Stiff Daisy	
basaltica, F.v.M.	Basalt Daisy	
trachycarpa, F.v.M.	Rough Daisy	
exilis, Sonder	Slender Daisy	

VERNACULAR NAMES OF VICTORIAN PLANTS—*continued.*

Botanical Name.	Popular Name.	Use or Character.
SYMPETALEÆ PERIGYNÆ—*continued.*		
COMPOSITÆ—*continued.*		
Brachycome—continued—		
ptychocarpa, F.v.M.	Tiny Daisy	
debilis, Sonder	Weak Daisy	
decipiens, Hook. f.	Field Daisy	
carolocarpa, F.v.M.	Swamp Daisy	
nivalis, F.v.M.	Snow Daisy	Several species might be improved by selection and cultivation, more especially B. nivalis, B. scapiformis, stricta, and multifida.
scapiformis, D.C.	Coarse Daisy	
stricta, D.C.	Erect Daisy	
ciliaris, Lessing	Fringe Daisy	
eriocarpa, F.v.M.	Desert Daisy	
chrysoglossa, F.v.M.	Golden Daisy	
multifida, D.C.	Blue Daisy	
collina, Benth.	Hill Daisy	
Minuria—		
leptophylla, D.C.	Silky Minuria	Of no known economic value.
Cunninghamii, Benth.	Bush Minuria	
integerrima, Benth.	Smooth Minuria	
denticulata, Benth.	Downy Minuria	
suaveolens, F.v.M.	Fleshy Minuria	
Calotis—		
cuneifolia, R.Br.	Blindi Burr Daisy	
glandulosa, F.v.M.	Glandular Burr Daisy	
cymbacantha, F.v.M.	Yellow Burr Daisy	
crinacea, Steetz	Prickly Burr Daisy	
scabiosifolia, Sonder and F.v.M.	Rough Burr Daisy	Of no known economic value.
scapigera, Hook.	Tufted Burr Daisy	
anthemoides, F.v.M.	You Yang Burr Daisy	
lappulacea, Benth.	Common Burr Daisy	
microcephala, Benth.	Small-headed Burr Daisy	
plumulifera, F.v.M.	*Feathery Burr Daisy*	
hispidula, F.v.M.	Hairy Burr Daisy	
Olearia—		
megalophylla, F.v.M.	Large-leaved Aster	
alpicola, F.v.M.	Alpine Aster	
viscosa, Benth.	Viscid Aster	
pannosa, Hook.	Velvet Aster	
argophylla, F.v.M.	Musk Aster	
myrsinoides, F.v.M.	Myrsine Aster	
dentata, Moench	Wrinkled Aster	
speciosa, Hutch.	Showy Aster	
stellulata, D.C.	Snow-bush Aster	
Frostii, F.v.M.	Hoary Aster	
asterotricha, F.v.M.	Rough Aster	
tubiflora, Benth.	*Tube Aster*	
axillaris, F.v.M.	Coast Aster	
ramulosa, Benth.	Twiggy Aster	Many are worthy of garden culture, more especially O. myrsinoides, O. argophylla, O. speciosa, O. stellulata, O. dentata, ramulosa, ciliata, pimeleioides, megalophylla, pannosa, and gunnis. The wood of O. argophylla is used in cabinet work, and its foliage is fragrant.
floribunda, Benth.	Heath Aster	
microphylla, Benth.	Small-leaved Aster	
lepidophylla, Benth.	Club-moss Aster	
subspicata, Benth.	Spiky Aster	
pimeleioides, Benth.	Pimelea Aster	
iodochroa, F.v.M.	Violet Aster	
calcarea, F.v.M.	Limestone Aster	
magniflora, F.v.M.	Large Aster	
Muelleri, Benth.	Dusky Aster	
decurrens, Benth.	Clasping Aster	
Toppi, Ewart and White	Mallee Aster	
glutinosa, Benth., torulosa, F.v.M.)	Sticky Aster	
teretifolia, F.v.M.	Desert Aster	
Hookeri, Benth.	Rare Aster	
glandulosa, Benth.	Swamp Aster	
stricta Benth.	Erect Aster	
arbuscula, F.v.M.	Bush Aster	
pterigifolia, Benth.	Rasp Aster	
rudis, F.v.M.	Harsh Aster	
ciliata, F.v.M.	Blue Aster	
Celmisia—		
longifolia, Cass	Silver Celmisia	Worthy of garden culture especially in mountainous districts or in rockeries.

VERNACULAR NAMES OF VICTORIAN PLANTS—*continued.*

Botanical Name.	Popular Name.	Use or Character.
SYMPETALEÆ PERIGYNÆ—*continued.*		
COMPOSITÆ *continued.*		
Cratystylis—		
conocephala, Sp. le Moore	Cone Aster	Of no known economic value.
Vittadinia—		
australis, A. Rich ..	New Holland Daisy ..	
Erigeron—		
pappochromus, Labill. ..	Violet Fleabane ..	
laiuriodes, Benth. ..	Hill Fleabane	
conyzoides, F.v.M. ..	Coast Fleabane	
Epaltes—		
Tatei, F.v.M.	Dwarf Epaltes	
Cunninghamii, Benth. ..	Erect Epaltes	
australis, Less*ing* ..	Spreading Epaltes ..	
Stuartina—		
Muelleri, Sond.	Spoon Cudweed ..	
Gnaphalium—		
luteo-album, L. ..	Jersey Cudweed	
japonicum, Thunb. ..	Japanese Cudweed ..	
collinum, Labill. ..	Creeping Cudweed ..	
alpigenum, F.v.M. ..	Mountain Cudweed ..	
purpureum, L.	Purple Cudweed ..	
indutum, Hook. f. ..	Tiny Cudweed	
Traversii, Hook. f. ..	Stalked Cudweed ..	
Parantennaria—		
uniceps, Beauv. ..	Mountain Everlasting ..	Might be worthy of garden culture in mountainous districts or in rockeries.
Euantia—		
Catipes, Beauv. ..	Silver Edelweiss	
nubigena, Beauv. ..	Brown Edelweiss ..	
Podotheca—		
angustifolia, Cass ..	Narrow-leaved Podotheca	Of no known economic value.
Ixiolæna—		
leptolepis, Benth. ..	Stalked Ixiolæna ..	
tomentosa, Sond. and F.v.M.	Woolly Ixiolæna ..	
Podolepis—		
rhytidochlamys, F.v.M. ..	Wrinkled Podolepis ..	Worthy of garden culture more especially P. acuminata.
longipedata, Cunn. ..	Long Podolepis	
acuminata, R.Br. ..	Large Podolepis	
canescens, Cunn. ..	Grey Podolepis	
rugata, Labill.	Pleated Podolepis ..	
Lessonii Benth. ..	Wiry Podolepis	
Sieberiana, F.v.M. ..	Slender Podolepis ..	
Athrixia—		
tenella, Benth.	Wire Wort	
Leptorhynchos		
squamatus, Lessing ..	Scaly Buttons	Of no known economic value.
panaetioides, Benth. ..	Woolly Buttons	
tenuifolius, F.v.M. ..	Slender Buttons ..	
ambiguus, Benth. ..	Doubtful Buttons ..	
pulchellus, F.v.M. ..	Beauty Buttons	
elongatus, D.C.	Lanky Buttons	
Waitzia, Sonder. ..	Immortelle Buttons ..	
linearis, Less.	Shiny Buttons	
Waitzia—		
acuminata, Steetz. ..	Immortelle	Worthy of garden cultivation.
Helipterum		
anthemoides, D.C. ..	Camomile Sunray ..	All are more or less worthy of garden culture especially H. floribundum, H. *Cotula* and *H. moschatum.*
polygalifolium, D.C. ..	Milkwort Sunray ..	
floribundum, D.C. ..	Profuse Sunray	
incanum, D.C.	Hoary Sunray	
Cotula, D.C.	Mayweed Sunray ..	
Jossenii, F.v.M. ..	Orange Sunray	
hyalospermum, F.v.M. ..	Golden Sunray	
strictum, Benth. ..	Erect Sunray	
corymbiflorum, Schlech. ..	White Sunray	
microglossum, Maiden and Betche	Silver Sunray	
pygmaeum, Benth. ..	Pygmy Sunray	
moschatum, Benth. ..	Musk Sunray	
laeve, Benth.	Smooth Sunray ..	
exiguum, F.v.M. ..	Tiny Sunray	
dimorpholepis, Benth. ..	Common Sunray ..	

Vernacular Names of Victorian Plants—*continued.*

Botanical Name.	Popular Name.	Use or Character.
Sympetaleæ Perigynæ—*continued.*		
Compositæ—*continued.*		
Helichrysum—		
Baxteri, Cunn.	White Everlasting ..	
ruticlelepis, D.C. ..	Pale Everlasting ..	
scorpioides, Labill. ..	Curling Everlasting ..	
Tepperi, F.v.M.	Delicate Everlasting ..	
obtusifolium, Sond. and F.v.M.	Blunt Everlasting ..	
decurbatum, Labill. ..	Silver Everlasting ..	
bracteatum, Willd. ..	Golden Everlasting ..	
elatum, Cunn.	Tall Everlasting ..	
semiamplexicaule, F.v.M. ..	Slender Everlasting ..	All are more or less worthy of garden culture, and many should find permanent places in our gardens, especially *H. Baxteri*, *H. bracteatum*, *H. Blandowskianum*, *H. rosmarinifolium*, *H. obcordatum*, *H. elatum*, and *H. Stirlingii*.
leucopsidium, D.C. ..	Satin Everlasting ..	
Blandowskianum, Sprctz ..	Woolly Everlasting ..	
apiculatum, D.C. ..	Pointed Everlasting ..	
semipapposum, D.C. ..	Downy Everlasting ..	
dictophyllum, F.v.M. ..	Heath Everlasting ..	
adnatum, Benth. ..	Rough Everlasting ..	
cinereum, F.v.M. ..	Coast Everlasting ..	
rosmarinifolium, Less. ..	Rosemary Everlasting ..	
ferrugineum, Lessing ..	Shrubby Everlasting ..	
Stirlingii, F.v.M. ..	Mountain Everlasting ..	
obcordatum, F.v.M. ..	Grey Everlasting ..	
Backhousii, F.v.M. ..	Rieeflower Everlasting ..	
cuneifolium, F.v.M. ..	Wedge Everlasting ..	
baeehanoides, F.v.M. ..	Alpine Everlasting ..	
Cassinia—		
longifolia, R.Br. ..	Shining Cotton-wood ..	Might be improved by garden culture.
aculeata, R.Br.	Common Cotton-wood ..	Of no known economic value.
quinquefaria, R.Br. ..	Slender Cotton-Wood ..	
arcuata, R.Br.	Drooping Cotton-Wood or Chinese Scrub ..	Proclaimed under the Thistle Act for the Shires of Maldon and Waranga.
spectabilis, R.Br ..	Showy Cotton-Wood ..	Worthy of cultivation as an ornamental plant.
Humea—		
*elegans, Smith	Plumed Humea	A biennial plant worthy of garden culture.
ozothamnoides, F.v.M. ..	Cottony Humea ..	Of no known economic value.
squamata, F.v.M. ..	Scaly Humea	
Rutidosis—		
lejolepis, F.v.M. ..	Rock Wrinklewort ..	
leptorhynchoides, F.v.M.	Button Wrinklewort ..	
helichrysoides, D.C. ..	Grey Wrinklewort ..	Of no known economic value.
Pumilo, Benth. ..	Small Wrinklewort ..	
Animobium—		
alatum, R.Br.	Winged Sand Daisy ..	
Ixodia—		Well worthy of garden culture.
achilleoides, R.Br. ..	Ixodia	
Millotia—		
tenuifolia, Cass. ..	Soft Millotia	
Toreathus—		
pygmæus, Turcz. ..	Tiny Bowflower ..	
Muelleri, Benth. ..	Large Bowflower ..	
Quinetia—		
Urvillei, Cass.	Quinetia	
Myriocephalus—		
rhizocephalus, Benth. ..	Dwarf Thick-Heads ..	
Stuartii, Benth. ..	Tall Thick Heads ..	
Angianthus—		
tomentosus, Wendl. ..	Hairy Cupflower ..	
brachypappus, F.v.M. ..	Spreading Cupflower ..	Of no known economic value.
tenellus, Benth. ..	Slender Cupflower ..	
pusillus, Benth. ..	Dwarf Cupflower ..	
Preissianus, Benth. ..	Flat Cupflower	
strictus, Benth. ..	Stiff Cupflower	
Gnephosis—		
Baracchiana, Ewart and White	Dwarf Gnephosis ..	
skirrophora, Benth. ..	Woolly Gnephosis ..	
Eriochlamys—		
Behrii, Sond. and F.v.M. ..	Woolly Mantle	

VERNACULAR NAMES OF VICTORIAN PLANTS—*continued.*

Botanical Name.	Popular Name.	Use or Character.
	SYMPETALEÆ PERIGYNÆ—continued.	
COMPOSITÆ—*continued.*		
Calocephalus—		
Drummondi, Benth. ..	Dwarf Beauty Heads ..	Considered to be injurious to stock, but this is usually merely due to a mechanical action on the bowels. The fluff from the flowers occasionally causes inflammation of the lungs in stock.
Brownii, F.v.M. ..	Coast Beauty Heads ..	
Sonderi, F.v.M. ..	Pale Beauty Heads ..	
lacteus, Lessing ..	Milky Beauty Heads ..	
citreus, Lessing ..	Lemon Beauty Heads ..	
Gnaphalodes—		
uliginosum, A. Gray ..	Flannel Cudweed ..	No known economic value.
Craspedia—		
Richea, Cassini ..	Big Billybuttons ..	Might be worthy of garden culture.
pleiocephala, F.v.M. ..	Small Billybuttons ..	
chrysantha, Benth. ..	Golden Billybuttons ..	
globosa, Benth. ..	Tall Billybuttons ..	
Chthonocephalus—		
pseudevax, Steetz. ..	Ground Heads	No known economic value.
Siegesbeckia—		
orientalis, L.	Indian Weed	A troublesome weed in arable land.
Eclipta—		
platyglossa, F.v.M. ..	Yellow Twin Heads ..	
Bidens—		
tripartita, L.	Trifid Bur-Marigold ..	
Glossogyne—		
tenuifolia, Cass. ..	Earwig Marigold ..	
Cotula—		
filifolia, Thunb. ..	Slender Cotula	Of no known economic value.
coronopifolia, L. ..	Swamp Cotula	
australis, Hook. f. ..	Common Cotula	
alpina, Hook. f. ..	Alpine Cotula	
reptans, Benth. ..	Creeping Cotula ..	
filicula, Hook. f. ..	Mountain Cotula ..	
integrifolia, Hook. f. ..	Thread Cotula	
Centipeda—		
orbicularis, Lapeirc ..	Spreading Sneezewood ..	Considered to be injurious to stock, but the injury is of a mechanical nature, the plants having no true poisonous properties.
Cunninghami, F.v.M. ..	Erect Sneezewood ..	
thespidioides, F.v.M. ..	Desert Sneezewood ..	
Abrotanella—		
nivigena, F.v.M. ..	Munyang Snow-Wort ..	Of no known economic value.
Elachanthus—		
pusillus, F.v.M. ..	Elacanth	
Isoetopsis—		
graminifolia, Turcz. ..	Grass Cushion	
Senecio—		
Gregorii, F.v.M. ..	Fleshy Senecio	All are more or less worthy of cultivation, especially *O. macrilloides*, *O. Sagnus*, *O. obovatus*, and *O. pectinatus*.
platylepis, D.C. ..	Toothed Senecio	
pectinatus, D.C. ..	Alpine Senecio	
spathulatus, A. Richard ..	Spoon Senecio	
magnificus, F.v.M. ..	Showy Senecio	
lautus, Soland.	Variable Senecio ..	
vagus, F.v.M.	Saw Senecio	
velleyoides, Cunn. ..	Forest Senecio	
australis, Willd.	Fire-Weed Senecio ..	
Behrianus, Sond. & F.v.M.	Stiff Senecio	
brachyglossus, F.v.M ..	Slender Senecio ..	
Georgianus, D.C ..	Grey Senecio	
odoratus, Hornemann ..	Scented Senecio ..	
Cunninghamii, D.C. ..	Branching Senecio ..	
Bedfordia—		
salicina, D.C. ..	Blanket Wood	*Timber* is useful for cabinet work (up to 15 inches in diameter). This plant yields a white flock from the under part of the leaves. Paper could be made *from* it, but as a source of paper material on a commercial scale, it would be insignificant.

Vernacular Names of Victorian Plants—*continued.*

Botanical Name.	Popular Name.	Use or Character.
Sympetaleæ Perigynæ—*continued.*		
Compositæ—*continued.*		
Erechtites—		
prenanthoides, D.C.	Toothed Fire-Weed	All are troublesome weeds.
arguta, D.C.	Rough Fire-Weed	
mixta, D.C.	Fluffy Fire-Weed	
quadridentata, D.C.	Cotton Fire-Weed	Proclaimed under the Thistle Act for the whole State.
hispidula, D.C.	Stiff Fire-Weed	A troublesome weed.
Cymbonotus—		
Lawsonianus, Gaudich	Cymbonotus	Has a slight pasture value.
Centaurea—		
australis, Benth. and Hook. f.	Austral Cornflower	Might be worthy of garden cultivation.
Microseris—		
Forsteri, Hook. f.	Murrnong Yam	The tubers are sweet and milky; were largely used as food by the aborigines.
Campanulaceæ.		
Lobelia—		
gibbosa, Labill.	Tall Lobelia	Worthy of garden culture. Flowers of a rich ultramarine blue.
rhombifolia, De Vriese	Longstalked Lobelia	Those belong to the sub-order Lobeliaceæ, all species of which contain a sharp, burning, or sometimes narcotic latex. When eaten in quantity, the plants are apt to cause internal inflammation, or ultimately death. This applies more particularly to Lobelia pratioides, Pratia erecta, and Isotoma fluviatilis; but Isotoma axillaris is worthy of garden culture for rockeries, &c.
anceps, L.	Angled Lobelia	
purpurascens, R.Br.	Purple Lobelia	
pratioides, Benth.	Poison Lobelia	
Pratia—		
gelida, Benth.	Snow Pratia	
platycalyx, Benth.	Fleshy Pratia	
erecta, Gaud.	Poison Pratia	
puberula, Benth.	Alpine Pratia	
pedunculata, Benth.	Slender Pratia	
Isotoma—		
axillaris, Lindl.	Rock Isotoma	
fluviatilis, F.v.M.	Swamp Isotoma	
Wahlenbergia—		
gracilis, A.DC.	Austral Bluebell	Might be improved by garden cultivation.
Stylidiaceæ.		
Stylidium—		
graminifolium, Swartz	Grass Trigger Plant	Might be improved by garden culture.
sobolifernm, F.v.M.	Bristly Trigger Plant	Of no known economic value.
calcaratum, R.Br.	Spurred Trigger Plant	
perpusillum, Hook. f.	Slender Trigger Plant	
despectum, R.Br.	Small Trigger Plant	
Levenhookia—		
dubia, Sonder	Hairy Stylewort	
Sonderi, F.v.M.	Slender Stylewort	
Brunoniaceæ.		
Brunonia—		
australis, Smith	Blue Pincushion	Well worthy of garden culture.
Goodeniaceæ.		
Dampiera—		
Brownii, F.v.M.	Mountain Dampiera	Worthy of garden culture. D. rosmarinifolia, and D. stricta are particularly recommended.
lanceolata, Cunn.	Grooved Dampiera	
marifolia, Benth.	Velvet Dampiera	
rosmarinifolia, Schlech.	Rosemary Dampiera	
stricta, R.Br.	Blue Dampiera	
Scaevola—		
spinescens, R.Br.	Prickly Fanflower	Of no known economic value.
hispida, Cav.	Hairy Fanflower	
aptecantha, F.v.M.	Winged Fanflower	
Hookeri, F.v.M.	Creeping Fanflower	
suaveolens, R.Br.	Scented Fanflower	A hardy evergreen trailer, worthy of garden culture.

VERNACULAR NAMES OF VICTORIAN PLANTS—*continued.*

Botanical Name.	Popular Name.	Use or Character.
SYMPETALEÆ PERIGYNÆ—*continued.*		
GOODENIACEÆ—*continued.*		
Scaevola—continued.		
crassifolia, Labill.	Coast Fanflower	Of no known economic value.
aemula, R.Br.	Fairy Fanflower	Worthy of garden culture.
microcarpa, Cav.	Small-fruited Fanflower	Of no known economic value.
Selliera—		
radicans, Cav.	Swampweed	Of no known economic value
Goodenia—		
stelligera, R.Br.	Spiked Goodenia	All more or less worthy of garden cultivation, especially G. hederacea, Macmillani, and G. amplexans. Several have a slight pasture value.
ovata, Smith	Hop Goodenia	
varia, R.Br.	Sticky Goodenia	
amplexans, F.v.M.	Clasping Goodenia	
barbata, R.Br.	Twiggy Goodenia	
geniculata, R.Br.	Bent Goodenia	
hederacea, Smith	Ivy Goodenia	
Macmillani, F.v.M.	Purple Goodenia	
cycloptera, R. Br.	Hairy Goodenia	
elongata, Labill.	Lanky Goodenia	
pinnatifida, Schlech.	Cut-leaved Goodenia	
pusilliflora, F.v.M.	Small-flowered Goodenia	
heteromera, F.v.M.	Spreading Goodenia	
glauca, F.v.M.	Pale Goodenia	
humilis, R.Br.	Tiny Goodenia	
paniculata, Smith	Panicled Goodenia	
gracilis, R.Br.	Slender Goodenia	
Velleia—		
connata, F.v.M.	Erect Velleia	Worthy of garden cultivation.
montana, Hook. f.	Mountain Velleia	
paradoxa, R.Br.	Spur Velleia	

(To be continued.)

WHEN renting a farm, trust to no verbal lease. Let it be in writing, signed, and sealed. Its stipulations then become commands, and can be enforced. Let it be signed in duplicate so that each party may have an original.

Insert such covenants as to repairs, manner of use, and in restraint of waste, as the circumstances call for, as to particular stipulations, examine leases drawn by those who have had long experience in renting farms, and adopt such as meet your case.

There should be covenants against assigning and under-letting.

If the tenant is of doubtful responsibility, make the rent payable in instalments. A covenant that the crops remain the lessor's till the lessee's contracts with him are fulfilled, is valid against the lessee's creditors. In the ordinary case of renting farms on shares, the Courts will treat the crops as the joint property of landlord and tenant, and thus protect the former's rights.

Above all, be careful in selecting your tenant. There is more in the man than there is in the bond.—Harris and Meyers, *Food for Plants*, 1905.

DRIED YEAST AS FOOD FOR STOCK.

The outstanding feature of yeast, regarded from the food standpoint, is its high content of albuminoids, which commonly constitute about 55 per cent. of the dry matter.

Fresh yeast and pressed yeast have been used to some extent in feeding cattle and pigs with apparently quite satisfactory results; but, as in these forms the yeast deteriorates rapidly, its use for feeding purposes is restricted to the neighbourhood of breweries.

With the construction of more efficient drying apparatus, it has now become possible to place on the market a dried yeast which is free from the foregoing objection, while retaining the nutrient matters of the yeast in a highly digestible form.

To the author's knowledge there are at present four or five yeast-drying plants at work in England, with an annual output of some 2,000 to 3,000 tons.

The product has so far been mainly exported from Germany, where dried yeast has grown in favour so rapidly that the demand is said to have exceeded the supply.

Dried yeast is of a powdery to flaky consistency, varying in colour from light to medium brown. It has an agreeable odour, and its flavour would not be amiss but for a bitterness, arising presumably from top residues. This bitterness, according to experience at Manor Farm, Garforth, which is the experimental farm of the University of Leeds and the Yorkshire Council of Agricultural Education, renders it distasteful to cows, but not to pigs and calves.

Percentage composition varies, but the following may be regarded as an average value: —

Moisture ...	...	4.3 per cent
Nitrogen ...	...	7.76 per cent. (equal to 48.5 per cent. albuminoids).
Oil ...	...	.50 per cent.
Crude Fibre	...	.50 per cent.
Ash ...	...	10.70 per cent.
Nitrogen-free Extract		35.50 per cent.

A summary of the results of the experiments at Garforth states dried yeast to be a safe food for cows, pigs, and calves. It proved good food for pigs, but owing to the cows' aversion to the bitter flavour, it is not strongly recommended as a cow fodder. It proved a safe food for calves, but no evidence was obtained as to its merits in comparison with other foodstuffs commonly used in calf-rearing.

In the case of pigs, comparative trials with rations consisting mainly of "sharps" (pollard) showed that the substitution of one-quarter to one-third of the latter by an equal weight of dried yeast gave markedly better results, and in spite of the higher cost of the yeast, the margin of profit on the feeding was undoubtedly increased.

—C. Crowther, in the *Journal of the Board of Agriculture*, 1915.

FIFTH VICTORIAN EGG-LAYING COMPETITION, 1915-1916.

Commenced 15th April, 1915; concluding 14th April, 1916.

CONDUCTED AT THE BURNLEY SCHOOL OF HORTICULTURE.

Six Birds. Pen No.	Breeds.	Owner.	Totals. 15.4.15 to 14.1.16	Totals. 15.1.16 to 14.2.16	Totals. Ten months.	Position in Competition.
		LIGHT BREEDS.				
		WET MASH.				
36	White Leghorns ..	G. McDonnell	1,278	119	1,427	1
34	,, ..	H. McKenzie and Son ..	1,253	152	1,405	2
42	,, ..	W. M. Bayles	1,234	142	1,376	3
2	,, ..	E. A. Lawson	1,253	115	1,368	4
19	,, ..	L. G. Broadbent ..	1,214	136	1,350	5
8	,, ..	C. J. Jackson	1,206	123	1,329	6
23	,, ..	Fulham Park	1,142	148	1,290	7
59	,, ..	W. G. Osburne	1,111	141	1,252	8
7	,, ..	Marville Poultry Farm ..	1,171	112	1,283	9
5	,, ..	J. J. West	1,171	111	1,282	10
30	,, ..	A. E. Silbereisen ..	1,146	132	1,278	11
28	,, ..	R. Lethbridge	1,129	141	1,270	12
3	,, ..	J. H. Gill	1,127	130	1,257	13
54	,, ..	W. H. Clingin	1,112	142	1,254	14
21	,, ..	E. B. Harris	1,156	96	1,252	15
16	,, ..	N. Burston	1,137	107	1,244	16
9	,, ..	J. Schwabb	1,125	106	1,231	17
39	,, ..	W. M. Sewell	1,101	125	1,226	18
11	,, ..	J. B. Brigden	1,103	116	1,219	19
6	,, ..	F. Doldissen	1,104	112	1,216	20
50	,, ..	John Hood	1,098	117	1,215	21
18	,, ..	D. Adams	1,096	116	1,212	22
44	,, ..	Mrs. F. M. Oliver ..	1,095	107	1,202	23
27	,, ..	J. A. Stahl	1,054	145	1,199	24
26	,, ..	A. Mowatt	1,084	114	1,197	25
58	,, ..	Thirkell and Smith ..	1,051	144	1,195	26
4	,, (5 birds)	R. Hay	1,091	103	1,194	27
20	,, ..	R. W. Pope	1,062	125	1,187	28
10	,, (5 birds)	A. E. Tuttleby	1,082	105	1,187	29
13	,, ..	T. Hustler	1,081	105	1,186	30
32	,, ..	F. Hodges	1,058	125	1,183	31
1	,, ..	Mrs. H. Stevenson ..	1,084	98	1,182	32
43	,, ..	H. L. Morrick	1,048	127	1,175	33
49	,, (5 birds)	Bennett and Chapman ..	1,051	114	1,165	34
24	,, ..	Lysbeth Poultry Farm ..	1,062	104	1,166	35
15	,, ..	H. N. H. Miratns ..	1,056	123	1,162	36
22	,, ..	S. Buscumb	1,049	130	1,179	37
33	,, (5 birds)	A. W. Hall	1,034	107	1,141	38
36	,, ..	Weldon Poultry Yards ..	1,006	123	1,129	39
53	,, (5 birds)	W. G. Swift	1,063	60	1,123	40
25	,, (5 birds)	Giddy and Son	1,036	81	1,117	41
55	,, ..	W. N. O'Mullane ..	1,004	113	1,117	41
60	,, ..	H. C. Brock	1,011	102	1,113	43
45	,, ..	C. J. Beatty	1,005	104	1,109	44
41	,, ..	J. A. Donaldson ..	989	113	1,102	45
47	,, ..	J. C. Armstrong ..	1,008	93	1,061	46
12	,, ..	G. Heyman	978	111	1,089	47
46	,, ..	R. Berry	960	120	1,080	48
40	,, ..	C. C. Dunn	941	123	1,064	49
52	,, ..	A. A. Sandland	938	114	1,052	50
37	,, ..	A. Ross	903	120	1,023	51
45	,, ..	South Yan Yean Poultry Farm	940	77	1,017	52
57	,, ..	B. Mitchell	912	92	1,004	53
14	,, ..	W. Flood	881	115	996	54
31	,, ..	L. McLean	844	118	962	55
53	,, (5 birds)	C. Hurst	798	105	903	56
		Total	59,681	6,568	66,249	

FIFTH VICTORIAN EGG-LAYING COMPETITION, 1915-16—*continued.*

Six Birds. Pen No.	Breeds.	Owner.	Totals. 15.4.15 to 14.1.16	Totals. 15.1.16 to 14.2.16	Ten months.	Position in Competition.
		LIGHT BREEDS.				
		DRY MASH.				
80	White Leghorns ..	W. H. Robbins	1,290	128	1,418	1
68	,, ..	H. McKenzie and Son ..	1,215	152	1,367	2
79	,, ..	Lysbeth Poultry Farm ..	1,116	134	1,250	3
76	,, ..	A. A. Sandland	1,100	143	1,243	4
63	,, ..	A. H. Padman	1,108	126	1,234	5
62	,, ..	Benwerren Egg Farm ..	1,086	132	1,218	6
69	,, ..	E. MacBrown	1,096	107	1,203	7
67	,, ..	C. C. Dunn	1,047	128	1,175	8
66	,, ..	E. A. Lawson	1,055	119	1,174	9
65	,, ..	Thirkell and Smith ..	1,039	131	1,170	10
71	,, ..	Moritz Bros.	1,034	123	1,157	11
61	,, ..	Mrs. H. Stevenson ..	1,027	129	1,156	12
72	,, ..	Mrs. E. Zimmerman ..	1,039	116	1,155	13
78	,, ..	H. Hanbury	1,035	78	1,113	14
64	,, (2 birds)	W. M. Bayles	1,060	44	1,104	15
73	,, ..	C. L. Lindrea	904	153	1,057	16
77	,, ..	South Yan Yean Poultry Farm	914	128	1,042	17
74	,, ..	J. H. Gill	809	93	902	18
75	,, (5 birds)	Fulham Park	781	87	868	19
		Total	19,746	2,254	22,000	
		HEAVY BREEDS.				
		WET MASH.				
86	Black Orpingtons ..	C. E. Graham	1,196	106	1,302	1
97	,, ..	Marville Poultry Farm ..	1,149	104	1,253	2
89	Rhode Island Reds	E. W. Hippe	1,077	115	1,192	3
85	Black Orpingtons ..	H. H. Pump	1,069	112	1,181	4
92	,, ..	J. Ogden	1,065	115	1,180	5
81	,, ..	Mrs. T. W. Pearce ..	1,060	117	1,177	6
100	,, (5 birds)	J. H. Wright	1,062	82	1,144	7
93	,, ..	L. W. Parker	1,041	93	1,134	8
88	,, ..	J. McAllan	1,010	97	1,107	9
91	,, ..	A. Greenhalgh	998	86	1,084	10
84	,, ..	Cowan Bros.	958	113	1,071	11
90	,, ..	L. McLean	973	90	1,063	12
87	,, ..	W. C. Spencer	947	96	1,043	13
90	,, (5 birds)	Oaklands Poultry Farm ..	963	75	1,038	14
98	Faverolles ..	K. Courtenay	906	117	1,023	15
95	Silver Wyandottes ..	W. H. Forsyth	867	75	942	16
94	Black Orpingtons (5 birds)	D. Fisher	803	63	926	17
83	Black Orpingtons ..	G. Mayberry	807	101	908	18
82	White Wyandottes	J. B. Brigden	635	67	702	19
96	White Orpingtons ..	Stranks Bros.	602	31	633	20
		Total	19,248	1,852	21,100	

MONTHLY REPORT.

Weather conditions were very changeable this month. Dry, hot winds were followed by much rain, and one or two cold snaps were against egg production. A number of birds are moulting, and, again, there are a lot of broodies. The egg output continues to be very satisfactory. Whilst the health generally is good, there are a few cases of ovarian trouble; these may be expected occasionally amongst exceptionally heavy layers. Temperature, lowest, 52 F.; highest, 108 F. Rainfall, 366 points.

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ORCHARD AND GARDEN NOTES.

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The Orchard.

GREEN MANURES.

If a cover crop of leguminous plants is required for green manuring a start at planting may now be made. This can only be done when all the fruit has been gathered from the trees. An early crop is a distinct advantage. The cover crop should make a good growth before the winter sets in, as the plants make very little headway in the cold weather, and they require to be ploughed in as soon as the ground is dry enough in early spring. It will thus be seen that it is necessary to get a good autumn growth, as dense as possible, and one which will well cover the surface before winter.

CULTIVATION.

Should the weather become hot and dry it will be very necessary to give the land surface a good stirring, so as to conserve water supplies. Where fruit crops have been gathered a start may be made late in the month with the autumn ploughing: whatever ploughing is done should be left as rough as possible.

PESTS.

No codlin moth-affected or diseased fruit of any kind should be left on the ground after the crop has been gathered. These should all be destroyed by boiling.

All rust-affected foliage and fruit of plum and peach trees, as well as all other stone fruits that have been attacked by this and other fungus diseases, such as shot-hole, &c., should be burned if possible. This will minimize the possibility of future attacks.

The Vegetable Garden.

Autumn weeds must be kept out of the kitchen garden. These rapidly grow, and remain as robbers right through until the spring time.

The section should be well dug over for planting winter crops. Before digging a light sprinkling of bonedust and a good top dressing of stable manure should be spread on the surface. These may then be dug in, as they provide humus for the soil. Large plots should be avoided in winter; where such occur a path should be run down the centre. This will provide more efficient drainage. The beds, too, may be more raised than in the summer time.

Early onions may be planted out in the beds, and, if not already done, onion seed should be planted at once.

All classes of seedlings may be planted out, and seeds of lettuce, early peas, beet, carrots, radish, cabbage, cauliflower, and swede turnip may be sown.

Asparagus beds should be cleaned up and cut down as soon as the berries begin to colour. Celery rows should be kept earthed up: rhubarb beds should be given a dressing of manure to encourage the coming winter crop, and new rhubarb plantations may now be established.

The Flower Garden.

All classes of spring-flowering bulbs may now be planted. In bulb planting the bulbs should not come in contact with any manure. The manure should, some time previously, have been dug well in, and mixed with the soil, and all heat should have disappeared. If manure is required it should be placed below the bulb, so that the roots may ultimately penetrate to it. Bulbs thrive in sandy soils, and where the soil is heavy a little sand may be added to advantage. Bulbs should not be planted too deeply; the depth to plant is generally regulated by the size of the bulb. Such bulbs as freesias may be covered with only an inch of soil, while larger bulbs may be somewhat deeper.

Dahlias and chrysanthemums may be fed with liquid manure, or mulched with stable or poultry manure. In any case the feeding should not be too strong nor too frequent, and it should always be withheld before the flowers come.

All hardy annual, biennial, and perennial seeds may now be planted. Among these are dianthus, candytuft, sweet peas, Iceland poppies, anemone, ranunculus, stock, wallflower, columbine, foxglove, phlox, penstemon, pansy, gaillardia, &c.

Wherever aphis and red spider occur the plants should be sprayed with benzole emulsion, nicotine, pestend, or soaperine, or some other preventive in order to protect the coming flowers. Mildew attacks on the rose should be warded off by the use of sulphur. The sulphur may be either dusted on the plant or it may be scattered on the ground around and under the plant.

March is one of the best months for transplanting evergreen plants of all classes, trees, shrubs, and palms. The roots of the transplanted plants should be disturbed as little as possible, while the roots of those transplanted from pots should be well uncoiled and set out before planting.

The soil is now warm, and the roots will quickly take hold and grow. They are thus established for the winter, and will give little or no trouble in the subsequent summer heat and dryness.

REMINDERS FOR APRIL.

Live Stock.

HORSES. Those stabled should be fed liberally. Food of a more stimulating nature can now be given to get them well over the "changing coat" season. Those doing fast or heavy work should be clipped; if not wholly, then trace high. The legs should not be clipped. Those not rugged on coming into the stable at night sweating freely should be wiped down and in half-an-hour's time rugged or covered with bags until the coat is dry. Yearling colts if vigorous and well grown may be castrated. Weaned foals should have a little crushed oats daily, if available. Horses to be turned out during winter should not be clipped. Their mouths and feet should be examined and attended to where necessary.

CATTLE.—As the nights become colder the dairy cows should be rugged. The rugs should be removed in day-time when the shade temperature reaches 60 degrees. If new grass is plentiful, give a ration of hay or straw, whole or chaffed, to counteract the purging effects of young grass. Cows may now be spayed.

PIGS.—Sows not already served should be put to the boar. Supply all pigs with plenty of bedding, and see that sties are warm and well ventilated. Supply sows liberally with grain. Castrate young boars as early as possible. Pigs should be highly profitable now, as feed is cheap, and pork very dear.

SHEEP.—Merino and fine cross ewes, if they have been mated early, will lamb from now on. Those in lamb to the larger British breeds of rams will give a certain amount of trouble in lambing, and anticipating the extreme value of meat and wool close attention should be given morning and evening to save every lamb possible, and any ewes that may be cast. If the ewes are well-woolled sorts, they will need crutching for fly, at the same time clear wool from around teats, and away from the eyes also. If the ewes are attentive mothers any lambs that are found dead after these precautions, apart from weather conditions, foxes, &c., are just as well gone. Give purgative drenches at first sight of ewes appearing ill in any way. Give warm salad oil to any lambs that are dull in appearance. Ewes after difficult parturition or retention of after-birth can often be saved by flushing out. Reserve fresh pasture, or better still, sow a mixed green crop to turn ewes into later on, but not while carrying the lambs, this is too often injurious. On fine mornings when attending ewes, if feed is plentiful and ewes strong castrate as many ram lambs as possible, they are easily caught when two or three days old. Place them between the feet on the ground, no holder is necessary. In districts where conditions make second dipping a necessity, see that it is done before the weather becomes too unsettled.

POULTRY.—Do not feed maize this month- soft food aids moult; add a teaspoonful of linseed to each bird's ration once daily. The more exercise the hens get the better they moult. Remove all male birds from pens. Add to drinking water one packet Epsom salts to twenty birds. Keep a sharp look out for chicken pox. Forward pullets should now be in their winter quarters, with plenty of scratching litter, and fed liberally—including ration of animal food. Grit shell and charcoal should always be available.

Cultivation.

FARM.—Dig potatoes as they mature. Cart out and spread stable manure. Finish preparation of land for main cereal crops. Sow Chou Moellier seed in beds for transplanting. Sow the following mixture per acre for green feed during the winter months for the dairy herd:—1½ bushels, Oats; ½ bushel, Cape Barley; ½ bushel, Tick Beans; ½ bushel, Vetches. Sow Giant Drumhead Cabbage for transplanting (1 lb. sufficient for 1 acre, in rows 3 feet apart); provided the soil is in good friable condition, plants from seed sown last month should be planted out. Sow wheat and oats according to locality; also rape for winter feed or green manuring. Prepare clean seed-bed for lucerne; and sow Hunter River, Arabian, or Peruvian seed, free from dodder, in drills 7 inches apart and at the rate of 12-16 lbs. of seed per acre. Sow permanent pastures with grasses and clovers.

ORCHARD.—Prepare land for planting; plough deeply and sub-soil. Plant legumes for green manure. Plant out strawberries. Clean up Codlin Moth from trees as soon as all fruit is gathered.

FLOWER GARDEN.—Plant out evergreen shrubs, trees, and Australian plants, divisions of herbaceous plants, seedlings, layers, and rooted cuttings. Feed chrysanthemums with liquid manure weekly until flowers begin to open. Prepare land for future plantings of roses and shrubs.

VEGETABLE GARDEN.—Plant out seedlings from the seed beds. Dig all vacant spaces roughly. Sow onions for early crop; also peas and broad beans. Clean out asparagus beds wherever the seeds are ripening.

VINEYARD.—Consideration must be given to manuring; early application is strongly urged. Peas, &c., for green manuring should be sown as soon as possible.

Cellars.—Cleanliness is emphatically urged. Carefully remove all fermentable refuse—skins, lees, skimmings, &c. Such odds and ends favour multiplication of Vinegar Flies (*Drosophila funebris*). If present destroy these with formalin or insecticide powders. A little bisulphite or sulphurous acid in washing water is recommended; also free use of lime on floors, &c. See February *Journal*, 1914.